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Vol. VII. NEW YORK, MAY 15, 1886. No. 20.

THE Western office of THE ELECTRICAL WORLD has been removed from No. 23 Borden Block, Chicago, to No. 44 Lakeside Building. Mr. Kreidler, the Western manager, will be glad at all times to see the friends of the paper and to do them any service that may lie in his power. He will attend promptly to any business connected with any department of the paper, or with the Patent Agency.

WE give space in this issue to a letter from abroad, which is a curious mixture of fact and fiction, and shows to what extent some people, even when well-informed, are driven to find a comprehensive theory for that mysterious force—electricity. That the latter is made out to be an *element* is something entirely new in its way and is quite amusing. Our correspondent evidently is not able to distinguish between a force and the effects of a force, and so far as his arguments go they might just as well be applied to light, heat, gravity or any other of the forces in nature. Because the action of a force produces a change in a body he reasons that the change is brought about by a combination in which the force is a new element added to the original body. It needs no elaborate argument to show the falsity of this assumption, which we think will not be seriously regarded by our readers.

THE Executive Committee of the National Electric Light Association, in naming Aug. 31 as the day for the Detroit meeting, has made a decision that will be very generally approved. It will conveniently enable the members, many of whom are desirous of so doing, to go on to the telephone convention at St. Louis the following week, and thus "kill two birds with one stone." The precedent now set will probably be observed from year to year.

ONE of the little, yet serious, difficulties of underground systems is brought out in the fact that as many as 463 subscribers of the Metropolitan Telephone Company of this city changed their offices during the last two weeks of April. The removals are still going on, but not to so large an extent as at first. Any one who knows anything of running wires will see at once the enormous amount of work involved in the necessary changes of circuits with aërial wires, and can also realize that with underground wires hard to get at the execution of the work would well-nigh become an impossibility.

IT may seem a novelty to many of our readers to have the mechanical action of an arc lamp treated mathematically, but such determinations often serve to point out methods of construction by which better results are obtained than were heretofore possible. Thus, according to Mr. Keilholtz, a clutch, to be theoretically perfect, should operate to produce a continuous decrease of pressure upon the electrode. There are several forms of lamp mechanism in which this principle is embodied, and that adopted by Mr. Keilholtz is also interesting, the torsion of a spring being the medium by which the effect is obtained. The descriptive article in this issue on the subject deserves careful reading.

THE literature of electricity, of late so scant, is now growing apace, and the reader who makes up his mind to be familiar with all the electrical books that are published has abundant occupation for his leisure. The revised list of books, to be found in our advertising pages this issue, embracing all the best publications on electrical science and application, shows that the demand for authoritative treatises on important subjects is being satisfactorily met. He who would keep abreast of the development in electricity to-day must be, so far as his own field is concerned, a well-read man. It will perhaps be noticed that two of the subjects in our list are still somewhat inadequately represented—storage batteries and the transmission of power. Both these themes are comparatively new, and no one has yet ventured on any elaborate work regarding either of them.

STORIES of sudden death by electric light shocks are becoming so frequent that they should be investigated. If a man drops dead anywhere near an electric light, we are told that he leaned against a lamp-post, that a telephone wire rested thereon, and that an electric light wire fell across the latter. Nobody leans against a lamp-post more than does a policeman, for he performs little other service all night, yet no policeman was ever shocked to death. We do not believe half these stories, but if there is any truth whatever in them, our electricians should lose no time in devising ways and means to throw every safeguard around one of the greatest and most useful inventions of modern times. Another profitable subject of investigation would be the proper treatment of persons who might receive an undue shock from electricity. One knowing electrician says that a person having received an apparently fatal shock can be revived by reversing the current; that is, giving him another shock, putting the positive pole where the negative had been before. This is a good deal in the nature of swallowing a hair of the dog that bit you, but the whole subject is worthy of consideration, and some formula might be laid down for treating a person suffering from electric shock.

THE dispatch from Paris, printed in a late issue, saying that it is proposed to erect for the coming International Exhibition in Paris, an iron tower 984 feet high, "to be surmounted by a powerful electric light that will be visible, it is believed, as far as Dijon, which is 197 miles southeast of Paris," seems to be keeping some of the philosophers awake o' nights. The assertion is taken as evidence of the narrator's ignorance of the sphericity of the earth's surface, and "Bowditch's Navigator" is lugged in to prove it. This excellent work gives the distance at which the line of sight from different elevations meets the earth's surface or touches the horizon. From this it appears that the view will only extend about ninety-six miles from an elevation of one mile, or more than five times the height of the proposed tower, and, therefore, it is claimed that the elevation named, say 1000 feet, only extends the view about forty-two miles. Now it will puzzle these people to explain how the government's search light at the Electrical Exhibition in Philadelphia, at an elevation of about 60 feet, was plainly seen in Wilmington, Delaware, thirty miles distant. They forget that while the earth is round, the land is not uniformly so, like the ocean. Bowditch's calculations may do very well at sea, but if there is a valley or deep depression between two points, like Paris and Dijon, there is no reason why under favorable atmospheric conditions, the effulgence of the electric light should not penetrate the two hundred miles of clear space.

THANKS to the reductions in rates made by the "cable pool" and the Commercial Cable Company, the public is now enjoying the opportunity to do its cabling very cheaply, and it is likely there will be a considerable increase in the volume of business. It will be noticed the Messrs. Mackay and Bennett appeal to the public for support at 25 cents a word, and they say very plainly: "In the impending struggle, the existence of an independent and competitive Atlantic cable service is at stake, and our patrons must now pronounce for or against its maintenance." It is true that 12 cents a word is much less than 25, but since the 25 cents or 40 cents may be permanent, while the 12 cents is simply intended to kill off any company that stands between the "cable pool" and 60 cents, it may be well for the public to resist the temptation to pay 12 cents and to uphold the hands of the Commercial people. It is said that this view of the case is having its effect on many who use the cables extensively, but there are other persons to whom it will be a great convenience to send a ten-word dispatch for $1.20 from New York to Paris or from London to New York, and these latter will probably patronize the "pool." The fight promises to be a long and severe one, to be stopped solely by the exhaustion of the contending parties.

EVER since the variations of the magnetic needle were first observed, theories have been advanced to account for these strange phenomena, but even to-day no satisfactory solution of the entire question can be said to exist. As regards the cause of the secular changes in the earth's magnetic force, such as the varying angular deviation of the needle through a cycle of hundreds of years, no satisfactory theory can be said to have been proposed, and the true explanation of the phenomenon is as much a mystery to-day as when it was first puzzled over 300 years ago. The periodic magnetic changes have been more closely studied, but even in this field of investigation opinions still differ considerably. While some would trace the cause of diurnal variations of the needle to a magnetic origin, others believe it to be the effect of electrical action—actual currents. Even among those who are of the latter opinion, various theories are advanced regarding the nature and origin of the currents; heretofore the majority were inclined to the opinion that they had their origin within the body of the earth's mass. But according to such eminent men as Balfour Stewart, Dr. Shuster and others, whose deductions are given in another column, it would appear that the cause must be looked for beyond the surface of the earth, in the upper regions of the atmosphere. The theory advanced also places the aurora in the catalogue of electrical phenomena, and the action of this class of meteors seems well referable to such an origin, though at variance with the magnetic theory concerning them. There is much to be learned regarding all these phenomena, but the systematic study of the magnetic changes, undertaken within the last ten or fifteen years, must in time lead to some generalization which will explain much that is mysterious at present.

ONE of the most interesting of the lectures delivered this season before the Franklin Institute is that on the "History of the Electrical Art in the United States Patent Office," by Mr. C. J. Kintner, the able chief examiner in the class of electricity. His rapid review of the art as it is disclosed in the Patent Office files is indeed a history of the rise and growth of an art in which America has contributed her full share toward practical success. There are so many points in this interesting review that might be elaborated, that a full discussion of it would require more space than we have at our disposal; but we cannot refrain from emphasizing some facts which are therein presented. Mr. Kintner directs criticism once more to the enormous work performed by him and his limited corps of assistants, and though he makes no appeal for relief, as he has often done on other occasions, we can almost hear the sighs with which he gives utterance to this statement of the great labor performed under the disadvantages existing in the Patent Office. Attention is drawn to the fact that very few of the noted electrical inventions of early date were patented in this country; but things have now changed to such an extent that not only important, but minor foreign inventions are now patented here, our great enterprise holding out the promise of a speedy reward. Mr. Kintner also draws attention to a number of early patents which are little known, and which many present inventors find a stumbling block in their way. He instances one on storage batteries by Charles Kirchhoff as among the more noted of these, and a perusal of its contents reveals a profound knowledge of the subject on the part of the inventor. It is indeed strange that this promising application should have lain slumbering for more that twenty years, and then have been taken up with such vigor. Probably there are several more such inventions as these, of which the telephone is a notable example, requiring only the hand of genius to turn them to practical account and useful purpose.

An Absolute Electrometer Giving Continuous Indications.

BY MM. E. BICHAT AND R. BLONDLOT.

We have constructed an electrometer founded upon the attraction of two concentric cylinders, and which enables us to measure potentials in absolute values. This electrometer has the double advantage of being easily constructed and of giving continuous indications.

An insulated cylinder *A A* is connected to the source of the current whose potential is to be measured. A cylinder *B*, the axis of which coincides with the former, is suspended by the rod *T* to the scale *P* of a balance, and communicates with the ground by means of the beam of this balance. The cylinder *B B* plunges in part into a cylindrical vessel *C*, rather larger in diameter and communicating likewise with the ground.

A screen *E E E*, connected with the ground, allows the rod *T* to pass through an aperture; it serves to protect the balance against the attractions of the cylinder *A A*.

The cylinder *A* exerts upon the cylinder *B* a force directed from below upward, which may be valued by following a procedure analogous to that employed by Maxwell for establishing the theory of Sir W. Thomson's quadrant electrometer. The combination of the cylinders *B* and *A* forms a condenser; the length of these cylinders being sufficiently great in proportion to their diameters at the mean part of the cylinder *B*, and at the corresponding part of *A*, the distribution is the same as if they were infinitely long—that is, in this region the equipotential surfaces are concentric cylinders and the lines of force are the radii; above and below the distribution is different. If we suppose that the cylinder *B* projects out of *C* by a quantity which is not too great, we may consider the change in distribution as having consisted in a simple prolongation of the portion in which the distribution is the same as if the cylinders were infinitely long, the portion situate above, where the distribution is irregular, being simply displaced.

Let *R* and *r* be the respective radii of the cylinders *A* and *B*; *V* the potential of *A*, that of *B* being zero: let, further, *F* be the force which attracts the cylinder *B* from below upward. Let us suppose that the cylinder *B* is raised by a quantity *d z*, the work of the electric forces is then *F d z*. According to the theorem relative to the displacement of bodies at a constant potential, this work is equal to the increase of energy of the system. But the increase of charge is the product of *V* by the capacity of a portion of an indefinite cylindrical condenser of the height *d z*: it is therefore equal to

$$\frac{1}{2}\frac{V\,dz}{L\frac{R}{r}}.$$

In consequence the increase of energy is

$$\frac{1}{4}\frac{V^2\,dz}{L\frac{R}{r}}$$

and we have the equation

$$F\,dz = \frac{V^2\,dz}{4\,L\frac{R}{r}}.$$

Whence

$$V^2 = 4\,F\,.\,L\frac{R}{r}.$$

If we measure *R* and *r* in centimetres and *F* in dynes, we shall have V^2 in absolute units of the C. G. S. system.

To measure *F* we put marked weights upon the scale *P* of the balance, until the equilibrium is re-established.

The value of these weights expressed in grammes, multiplied by the number *g*, gives the force expressed in dynes.

In order to prevent the oscillations of the beam, we suspend in the place of the second scale of the balance a large pasteboard disc, which rises and falls in a glass cylinder, *D D*, of a rather larger diameter. The friction of the air renders the apparatus almost aperiodic, or dead beat.

The force *F* being, within wide limits, independent of the position of the cylinder *B*, it results that we may also make use of this instrument without employing weights, by merely observing the inclination of the beam. A mirror *M* fixed above the knife edge enables us to measure this inclination by the method of reflection. When the equilibrium is established, *F* is equal to a constant multiplied by the tangent of the angle of inclination. This constant is determined, once for all, by putting in the scale *P* a known weight, the electrometer being discharged and observing the corresponding deviation,

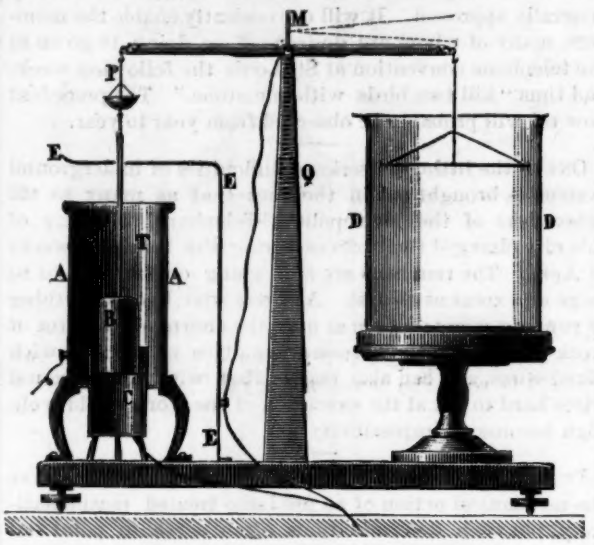
For small deviations the force *F* is proportional to the number of divisions which have passed before the cross wires of the telescope. A counterpoise *Q*, movable along a needle fixed perpendicular to the beam, enables the sensitiveness of the balance to be modified at will.

A calculation based upon the formula given by M. Blavier for the capacity of a condenser formed of two cylinders whose axes do not coincide, but are parallel shows that a lateral displacement of the cylinder *B*, even of two or three millimetres, has only an exceedingly small influence upon the value of the force *F*. This is because *F* is at a minimum when the two cylinders are concentric. In our apparatus, where $R = 5.875$ centimetres and $r = 2.5$ centimetres, *F* varies only by 0.008 of its value for a deviation of the axis of three millimetres.

In the calculation made above for determining *F*, the rod *T*, supporting the cylinder *B*, has not been taken into account. The complete expression for *F* is obtained by deducting from the action upon *B* that which is exerted upon the rod. If we call ρ the radius of the latter, the factor by which we must multiply the force to obtain the square of the potential is

$$4\left(L\frac{R}{r} - L\frac{R}{\rho}\right)$$

As a verification of the exactness of the indications of our apparatus, we have determined the potentials corresponding to a certain number of striking distances between



A NEW ABSOLUTE ELECTROMETER.

two spheres; the numbers obtained agree perfectly with those determined with great precision by M. Baille.—*Comptes Rendus.*

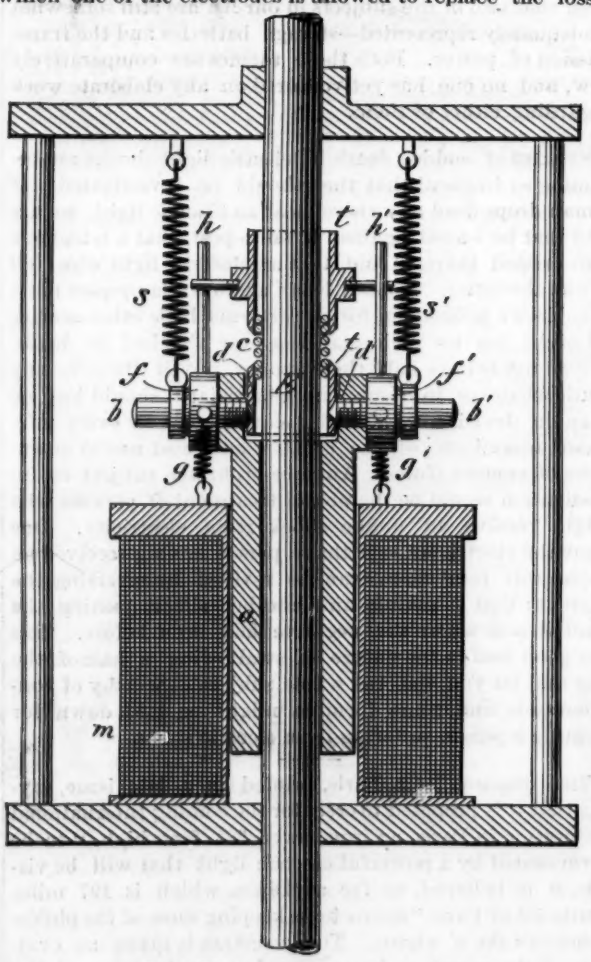
A New Arc Lamp.

BY PIERRE O. KEILHOLTZ, JOHNS HOPKINS UNIVERSITY.

It appears from a theoretical consideration that the scientific principle of arc lamps operated by a shunt magnet is, that the current in the electro-magnet of the regulating apparatus is *constant*, and, in general, the resistance of the arc is not. Such a lamp does not give a constant resistance except for a constant current, and in consequence the dynamo should be regulated for this alone.

The resistance of the arc depends upon the specific resistance of the materials employed when raised to the temperature of the arc, its area, and its length. The length of the arc depends entirely upon the lamp.

Various means have been designed to accomplish this result, the one most commonly employed being that in which one of the electrodes is allowed to replace the loss



THE KEILHOLTZ ARC LAMP.

from the consumption of both. In order, then, to keep the electrodes at a constant distance apart, one or both of them should move at a constant velocity, provided they are homogeneous and the current is uniform. A lack of homogeneity in the electrodes, leaving out impurities, will cause variations in the arc that cannot be corrected by a lamp moving one of them at a constant velocity. It is necessary, then, that we use homogeneous electrodes in lamps which have a constant velocity, or provide a lamp in which this is not essential. The problem is greatly simplified by using homogeneous electrodes free from impurities, but an absolutely uniform current must enter also. This doubles the difficulty. Without stopping to inquire whether they are obtainable, however desirable, I will state the requirements of a lamp designed to burn the ordinary carbons of commerce.

1. The moving parts should be small and as light as possible, so that their inertia will be a minimum.
2. The mechanism should be direct acting.
3. There should be no lost motion at the connecting joints.
4. The mechanism should be operated by the current.
5. Variations of electrical energy in the operating mechanism should produce corresponding movements of the electrodes.

The ordinary electric arc lamp consists essentially of two electrodes, one of which is fed by gravity, a clutch and operating mechanism actuated by the current. We will confine ourselves to the clutch.

A frictional clutch is a device whereby variations of pressure between it and the electrode, either directly or indirectly, produce a variation of motion of the electrode.

Calling the mass of the electrode *m*, the co-efficient of friction between the electrode and the clutch *f*, we have the following relation:

$$m\,g = A\,F\,f,$$

where *A* is a constant depending on the construction, *F* the normal squeeze.

Differentiating, we get

$$\frac{d\,F}{d\,m} = \frac{g}{A\,f}, \text{ a constant.}$$

A clutch, then, to be theoretically perfect, should operate to produce a continuous decrease of pressure upon the electrode.

The accompanying illustration shows a frictional clutch and operating mechanism that fulfills all the requirements. It consists of a coil spring through which passes the carrier rod *E*. If the ends of the spring be turned circumferentially, the diameter of the spring is increased or diminished according to whether the ends are turned in the same or opposite direction. The same result is reached if one end be held rigidly and the other turned. A half dozen turns of brass wire are coiled to a slightly larger diameter than the carrier rod. Two pieces of brass tube *t* and *t* are then fitted over the ends of the coil and soldered, allowing about two free turns of the spring. The lower tube is suspended by two pivots *d* and *d'*, and the upper one has secured a collar with two projecting arms. Pressing against these arms are two others *h* and *h'*, parts of two bell crank levers *f* and *f'*. To the ends of the other arms of these levers are attached two springs *g* and *g'*. Cross arms *b* and *b'* are secured to the core *a* of a solenoidal magnet *m*, forming the fulcrums for the bell crank levers. Two springs *s* and *s'* suspend the entire mechanism, including the carrier rod.

By certain manipulations of the shunt magnets, the clutch is regulated with the greatest delicacy. The clutch acts by a variation of pressure on the carrier-rod, the variation of pressure being produced by the electro-magnetic action of the current. If the core of the magnet is drawn down, the clutch experiences a less tangential force caused by the slackening of the springs *g* and *g'* attached to the bell crank levers, and consequently its own weight causes it to move downward, not with an accelerated but with a uniform motion, for three reasons: first, because of the friction between the clutch and the rod, the coil is never freed; secondly, the consequent less magnetic effect of the coil, and finally, the decreased weight sustained by the springs *s* and *s'*. The result of the last two effects is to increase the friction between the clutch and carrier-rod, by pressing the former more tightly against the latter. The operation of the clutch is effected by a shunt magnet simply and not by means of a shunt and main, or the two combined, a differential magnet.

Editors Before the Pan-Electric Investigating Committee.

The work of the Committee last week consisted chiefly in the examination of Mr. Charles A. Dana, of the New York *Sun*, and Mr. George Jones, of the New York *Times*. Mr. Dana testified on May 4 that the matter about the Pan-Electric Company, prepared by E. N. Hill and published by the New York *World* in January, had been tendered to him in September and declined. He did so because he did not wish to lead an attack on the administration. He regarded the story as scandalous, and thought that if half of it was true, it was most damaging to the administration. He had never published anything more than extracts from what had been published by others on this subject and comments upon them. The editorial comments were all written by himself, and were intended to induce the administration to extricate itself from its embarrassing postion. No one ever suggested the publication of anything which had appeared in the *Sun* on this subject, nor had any one ever promised to pay him for these publications. He frankly admitted that Mr. E. N. Dickerson had presented certain views of the case to him, in which he concurred. He said that he knew nothing of the Bell Company except that it charged extravagant prices for telephones, and the telephones did not always work well. He did not think that a Government officer should be connected with the Pan-Electric if the Government was to be brought in as ancillary prosecutor in behalf of the Pan-Electric, but he had no

objection to Government officers holding bank or railroad stock. He maintained that a private patent suit would be the same as a Government suit in effect. He did not understand that there was any such practice of instituting Government suits as had been followed in this case, and did not know that 10 such suits had been ordered by the Government since 1871. He gave his opinion, but with great modesty; he was not a lawyer.

The chairman asked if it was his view that the Attorney General should resign when such a suit was ordered, although he had taken no part in the order. The witness replied: "If it was impossible for him to prevent the bringing of such a suit in the name of the department of which he was the head, he should have done what any Cabinet Minister should do whenever anything is proposed to be done that he regards as entirely improper."

On the following day Mr. Jones appeared before the committee. He testified that both the Bell Company and the National Improved Telephone Company (Van Benthuysen's) had published in the *Times* articles as advertisements. The Bell Company paid its advertisement bills; Van Benthuysen did not. He also testified that he had been approached by Mr. Dickerson, of the Bell Telephone Company, last fall, with a view, apparently, to induce him to publish in the *Times* such articles in the interest of the Bell Company as afterward appeared in the *Sun*, *World*, *Tribune* and *Evening Post*. He had declined the proposition. His suspicions as to the motives of the other papers were revived by the appearance in their columns of such arguments as had been suggested to the *Times* by Dickerson. He did not see Dickerson himself. He was not in the office at the time. Nothing that appeared in the *Times* on the subject except the advertisements had been paid for or written by outsiders. On the other hand, the *Times* had spent $2,500 or $3,000, twice as much as the advertising brought in, for news on the subject in the shape of payments to correspondents, reporters, and for telegraph tolls. He said he had received last fall a letter from John M. Forbes, of Boston, formerly a member of the Republican National Committee, also an old friend of his, and father of William H. Forbes, of the Bell Telephone Company, asking him, for old acquaintance sake, to write President Cleveland in behalf of the Bell Company. He regarded this as a thing which it would be improper for him to do. He did not reply to this letter. He said he had no stock in any telephone or telegraph company. He did not know that any one on the *Times* had.

Mr. S. N. Clarke, one of the Washington correspondents of the New York *Tribune*, testified that he had written his first dispatch concerning Pan-Electric matters some two years ago, about the time the trouble had arisen in connection with the appointment of the House electrician. He had derived his information from several sources, including newspapers, patent attorneys and some of the Washington telephone people. Hill had brought in a statement and perhaps he (witness) had used some of the facts in the paper, but it had not been the basis of his articles. The witness repeatedly refused to disclose the names of the patent attorneys who had furnished him information, on the ground that it might tend to injure them in their business at the Patent Office, but he would say that they were not connected with the Bell or any other telephone company that he knew of. He had not gotten anything worthy of publication from the Bell people, and although he got a copy of the stenographic report of the proceedings in the committee made for the Bell company, he paid for it whenever he used it. Possibly he paid Hill $5 or $10 for his matter, but he had no recollection of having paid him anything. He (witness) had prepared the articles voluntarily. He thought he had "gotten hold of a good thing" and he sat down to "work it for all it was worth."

A New Contact for Automatic Train Signaling.

Railway automatic train signaling has occupied the attention of many inventors. One small item alone in this department has called forth considerable ingenuity of construction, and that is, the method of making and breaking the electrical contact at the required points. Without entering into a description of the various devices that have been proposed or are now in operation, we illustrate on this page a form of automatic contact which possesses several novel features.

Siemens and Halske have recently constructed this form of contact, which requires no external fixed point, contains no movable levers and can nevertheless be made to act with any desired degree of sensitiveness

The action of the apparatus depends upon the bending of the rail which takes place between two adjacent crossties, when the wheels of the train pass over it. In order to make such a small movement a means of accurate indication, a hydraulic transmission is employed to magnify the movement.

Our illustration, Fig. 1, for which we are indebted to

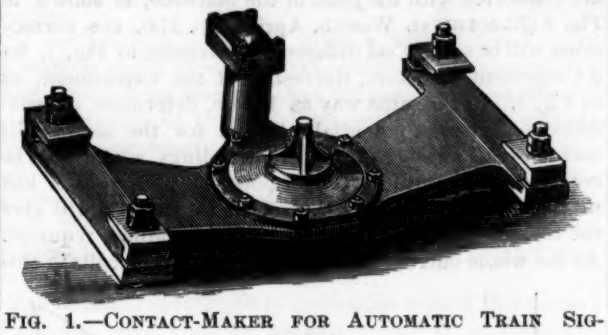


FIG. 1.—CONTACT-MAKER FOR AUTOMATIC TRAIN SIGNALING.

the *Elektrotechnische Zeitschrift*, shows the apparatus in perspeetive, and Fig. 2 as it appears attached to the rail. As will be seen, the flange of the rail has firmly bolted to it a cast-iron stirrup $M\,L\,L_1\,M$, and, as shown in the section Fig. 3, the central portion is spread out into a flat plate, which is closed by a plate of sheet-steel $b\,b$. An

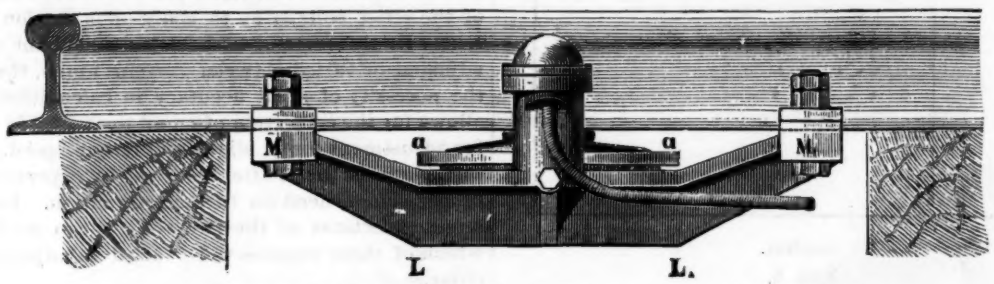


FIG. 2.—CONTACT-MAKER FOR AUTOMATIC TRAIN SIGNALING.

iron disc $c\,c$ rests upon this plate and is maintained in a central position by the pressure plug d. This plug is adjusted in such a manner that it just touches the under side of the rail, and between the latter and the cover plate there is a rubber washer t to prevent the entrance of sand to the plug opening. The space within the cover is closed by

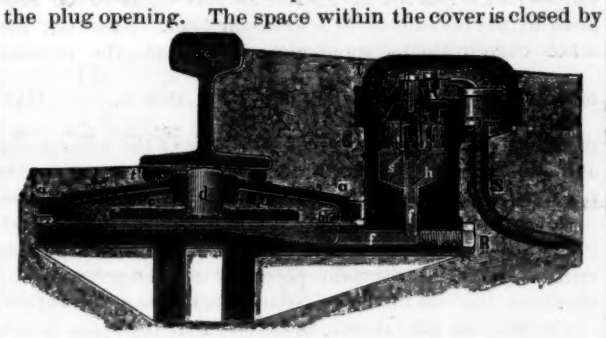


FIG. 3.—CONTACT-MAKER FOR AUTOMATIC TRAIN SIGNALING.

the plate $b\,b$ and communicates with the pot G by the passage and tube $f\,f$. This tube finally spreads out into the cup r. That part of the tube which rises into the cup consists of insulating material. A small opening in the tube at h and in the bottom of the cup at s both communicate with the free space of the pot, and their function will appear presently.

The space below the plate $b\,b$ and the pot G are filled with mercury so that the latter reaches up to the bottom of the cup r. The difference in level between the mercury in G and the plate $b\,b$ causes a hydraulic pressure of about 64 pounds to be exerted upon the pressure plug, which is thus firmly pressed upward against the rail. If, under these conditions, a car passes over the rail, the slightest bending in the latter drives the pressure plug down, moving disc c and plate $b\,b$, so that the mercury is driven out through the tube $f\,f$. As the area of the plate is to that of the tube in the ratio of 600 to 1, the cup r is quickly filled by a very small motion of the plate $b\,b$. After the train has passed over the contact rail the mercury runs out of the cup through the small opening s in the space of 10 seconds, and finds its way back into the tube f through the opening h, whence it flows back to the space under $b\,b$.

As will be seen, the fork i projects into the cup r, surrounds the insulated end of the tube f, and forms one terminal of the cable S. The fork is held in position by a glass cover p, which insulates it from the rest of the parts of the contact, as the whole iron work here constitutes the ground-plate of the circuit. It is evident then that the circuit can only be closed by the rising of the mercury in cup r, by which connection is made between the cable and the body of the apparatus.

It is also evident that the length of time during which the circuit is closed can be easily regulated by the position of the fork, which can be inserted into the cup to any depth, thus giving a corresponding time in which the mercury flows out of contact with it.

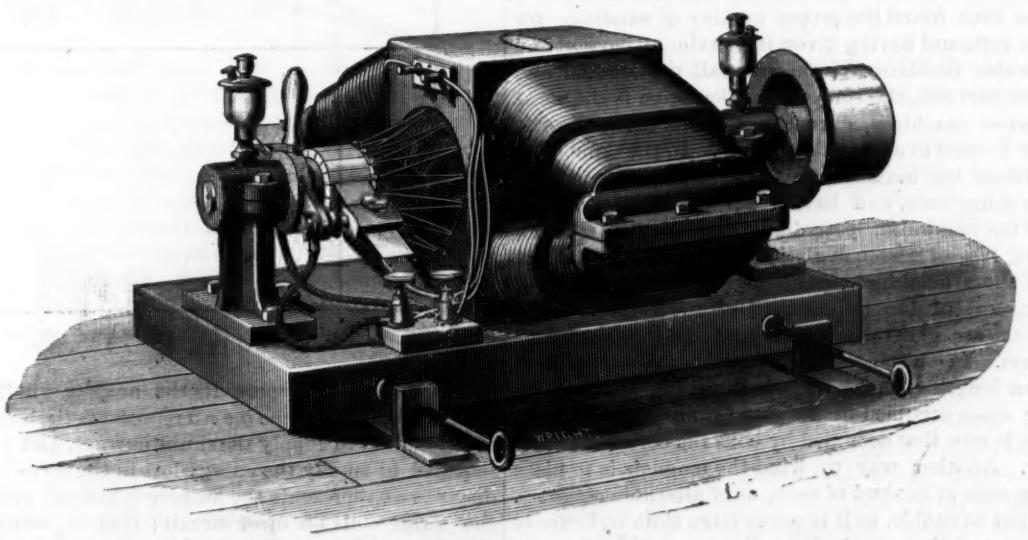
This form of railway signal contact presents a number of advantages, as it does away with all moving parts and levers which are liable to fail in time, and which send in signals that are unnecessary, as upon the passage of handcars, etc. Evidently only a heavy weight, such as that of a regular car, can cause a sufficient rise of mercury in the cup, so that no other signals are sent.

Lowell Telephone Syndicate Arbitration.

Col. John H. George, of Concord, N. H.; W. D. Caldwell, of Nashua, N. H., and Charles H. Allen, of Boston, arbitrators of the claims and counter claims of the Erie Telephone and Telegraph Company of New York on the one hand and William A. Ingham, Loren N. Downs, William H. Bent and others, members of what is known as the Lowell Telephone syndicate, on the other, gave hearings in the matter last week. These claims grew out of a suit brought by the Erie Company against the syndicate to recover $32,000, the amount of the alleged overcharge on the purchase of the Southeastern Dakota and the Arkansas Telephone companies. This was decided against the syndicate, and they refunded to the company the amount, with interest to July, 1883. Messrs. Ingham, Downs and Best then filed claims for compensation for services rendered as directors and officers of the Erie Company, and by mutual agreement these were left to a board of arbitration, whose decision should be final. The directors of the company then filed various claims to offset those of the syndicate, which were also referred to the arbitrators. These counter-claims of the Erie amount to $127,000, and are made up of alleged losses to it in the purchase of telephone lines, exchanges, inferior material, construction of lines and various other items made by the defendants. The counsel for the Erie Company before the arbitrators are Gen. Butler, Joshua N. Marshall and Wm. H. Anderson, of Lowell, and for the syndicate, G. F and D. S. Richardson, of Lowell, and M. F. Dickerson, of Boston. One interesting point that came out in evidence was that the syndicate had contributed toward the election of Gen. Butler as Governor of Massachusetts. The hearing will be resumed next week in Lowell.

The "Hecla" Dynamo.

Our illustration represents a dynamo which has recently been introduced, and has been designed by Mr. Ch. T. Jackson, electrician of the Hecla Electric Light Company, of this city. The dynamo, as shown in the accompanying engraving, has a Siemens armature, and the field magnets form consequent poles. They present but two joints at the ends where they are bolted together. The various sizes of the machine range from a capacity of 15 to 250 incandescent lamps, and from 1 to 25 arc lights. They are wound either in shunt or compound, according to the service for which they are designed, and have already been put in operation in several places.



THE "HECLA" DYNAMO.

New York Legislation.—The Assembly has passed the Senate bill providing for the assessment and taxation of telegraph, telephone and electric light wires and plant.

How to Wind the Magnets for Shunt, Series and Compound Machines.—VIII.

BY CARL HERING.

Compound Machines, Concluded.

These corrections will evidently be different in the two methods of winding. For the ordinary compound winding shown in Fig. 3 (see ELECTRICAL WORLD, April 17), in which the shunt coils are attached to the poles of the armature, let $g\ h$, Fig. 6, represent the same line as $g\ h$ in Fig. 5. In the same way as before, determine approximately the current required for the shunt circuit and the loss of potential allowed for the series coils. Lay off $o\ r$ equal to the shunt current (exaggerated in this diagram for the sake of clearness), then $r\ s$ will represent the ampère turns required in order to supply the necessary current for the shunt when the machine gives the proper potential on an open circuit. The currents in the lamp circuit will, therefore, be measured from r to the right; that is, they are equal to the whole armature current, $o\ i$ for instance, less that used in the shunt $o\ r$.

When the current flows through the lamps, and therefore through the series winding, the potential at the poles of the machine would fall by the amount which is absorbed by the series coils, for in the test the machine was run with constant potential at the armature. As this fall of potential increases with the current, it will have to be generated again by a corresponding increase in the number of series windings. Furthermore, as this fall of potential does not begin until the series coils begin to act, a line $s\ t$ drawn from s making a certain small angle with $s\ h$, would represent the necessary increase of the ampère windings, in order to increase the potential at the armature, so that at the poles of the machine it may be constant. Furthermore, if the potential at the armature poles be increased, the current in the shunt will be increased, for it is connected with these poles. The question then arises how many of the ampère winding will then remain for the series coils to generate. This may be calculated as follows: From the allowable loss of potential in the series coils at the maximum load, calculate by simple proportion what the total increased number of ampère turns must be; in other words, if the constant potential V volts requires $h\ i$ ampère windings, then $V + v$ volts (v being this loss) will require $\frac{V+v}{V}\ (h\ i)$ ampère windings. This gives the distance $i\ t$. Then $s\ t$ will represent the true corrected curve which gives the true values of the ampère turns which will so raise the potential of the armature that the potential at the poles of the machine will remain constant.

The proportion of this which will have to be allotted to the series coils is obtained as follows: Knowing the highest potential at the armature, $V + v$, and calculating the resistance R of the shunt coils from the potential on open circuit and the current in it, we are enabled to calculate what current will flow through it at the maximum load when the potential at the armature is $V + v$. This gives for the maximum current through the shunt $\frac{V+v}{R}$ which multiplied by the shunt windings give the ampère windings in the shunt for the full load. Therefore, if we lay this off at $i\ d$, then it will leave $d\ t$ ampère windings to be supplied by the series coils. Dividing this number of ampère windings, represented by $d\ t$, by the current in the external circuit (remembering to subtract that in the shunt for $d\ i$ ampère windings from the whole current $o\ i$) it will give the corrected number of windings for the series coils.

Having thus found the proper number of windings for the series coils and having given its maximum current and its allowable resistance (from the fall of potential and maximum current), the rest of the calculation is the same as for series machines, except that in this case the series coils are limited to a much less space. In the same way, having found the maximum number of ampère windings $i\ d$ of the shunt coils, and having given its allowable current and the maximum potential at the armature for full load, the rest of the calculation is the same as that for ordinary shunt machines.

On account of the inflexibility of the thick wire, the series coils are generally wound first and the shunt coils over them. In that case care should be taken to correct the mean length of the shunt windings; for what was before the space occupied by the core for an ordinary shunt machine, is now that occupied by both the core and series winding. Another way to wind the magnets is to place the series coils at one end of each, or of alternate magnets. This is not advisable, as it requires more time and care to wind them and they are likely to slip over one another unless held by a guard of some sort, which occupies valuable room in the coils.

The diagram also shows at a glance how the ampère windings are divided between the shunt and series coils. The line $s\ t$, Fig. 6, gives the corrected relation between the armature current and the required ampère windings for constant potential at the poles of the machine. The space below the line $s\ d$ will show how much of the magnetism is supplied by the shunt coils, while the space between $s\ d$ and $s\ t$ shows how much is supplied by the series coils. The space $s\ r\ o\ g$ shows the proportion of the whole number of ampère windings required to generate the current for the shunt coils, and the space $h\ s\ t$, that required to generate the potential lost in the series coils. If the current in the external circuit were $r\ z$, for instance, it would be seen at a glance that the machine was running very uneconomically, as about half the energy generated is absorbed by the magnets.

For the "long shunt" winding, in which the shunt coils are connected with the poles of the machine, as shown in Fig. 4 (ELECTRICAL WORLD, April 17, p. 174), the corrections will be somewhat different. Referring to Fig. 7, let $g\ h$ represent, as before, the results of the experiment, as in Fig. 5. In the same way as before, determine approximately the loss of potential allowed for the series coils and the total number of ampère windings which will be required to generate the proper potential plus what is lost in the series coils. Lay this off as $t\ i$, then $t\ g$ will give the corrected values for the ampère windings required. As the whole current passes through the series coils in this

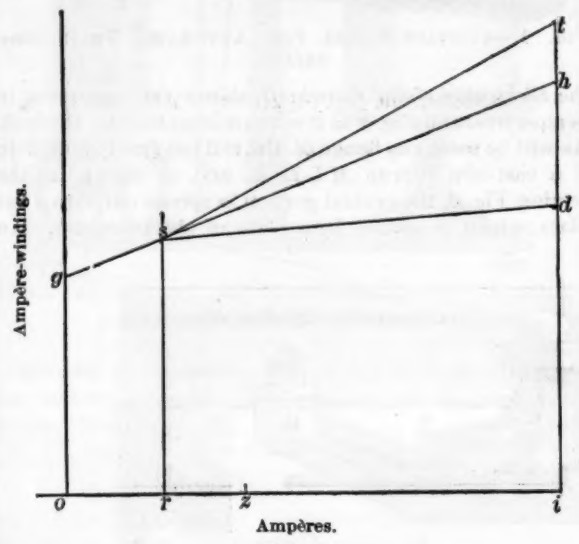


FIG. 6.

case, it is evident that their action will be proportional to the armature current and not to the external circuit current, as with the ordinary compound winding. From this it follows that the ampère windings for the shunt magnets must be that represented by $g\ o$, and as this is constant for any number of lamps, $g\ d$ is in this case horizontal, leaving $d\ t$ as the number of ampère turns to be supplied by the series coils at maximum load. Knowing the whole current (including shunt) at this load, the number of windings is the quotient of the two; that is, $\frac{d\ t}{o\ i}$. Having thus found the number of windings of the series coils, and having given its maximum current and its allowable resistance, the rest of the calculation is the same as before. In the same way, having found the ampère windings of the shunt coils, and having given its allowable current and the constant potential at the poles of the machine, the rest of the calculation is the same as before.

The diagram also shows, as before, that the space below $g\ d$ represents the ampère windings in the shunt; that be-

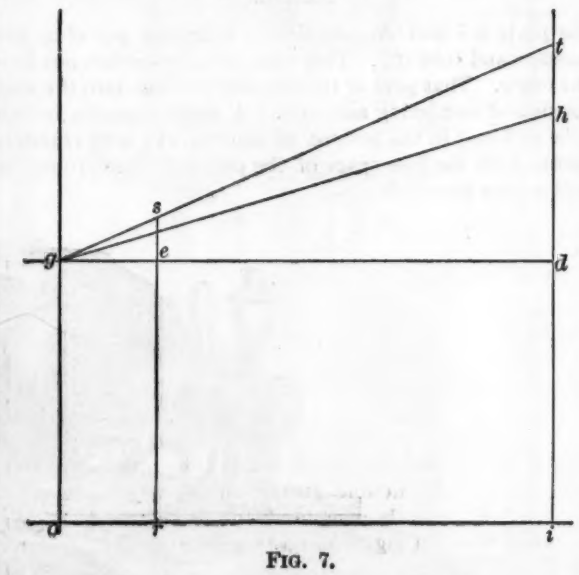


FIG. 7.

tween $g\ d$ and $g\ t$ represents the ampère windings in the series coils. The space $g\ e\ r\ o$ represents the ampère windings required to supply the shunt current, and $h\ g\ t$ that required to supply the energy lost in the series coils. The distance $s\ e$ represents the ampère windings generated by the series coils on open circuit; that is, when they act together with the shunt coils as such. It will be seen, by direct comparison of Figs. 6 and 7, in what manner the proportions of the different coils will vary in the two different systems. In Fig. 7, the shunt coils are evidently smaller, and the series coils larger.

In many systems of distribution for incandescent lamps, the potential at the lamps will fall with an increased number of lamps, owing to the increased current in the leads. If it is desired to correct for this in the winding of the machine magnets, it is only necessary to increase the number of series windings by the proper amount, in order to generate the desired increase of potential at the poles, which can readily be calculated. This correction is made in the same way as that for the loss of potential in the series winding. If this correction for leads is comparatively great, care should be taken to correct the shunt winding also, on account of the increased potential at its ends.

As will be seen from the above description, much greater care must be taken, and more accurate calculations must be made for compound machines than for ordinary shunt or series machines. A change in one quantity will affect several others; especially is this the case with the speed, which should be kept the same throughout; if it cannot be maintained constant, there is little use in attempting to make the machine more than a rough approximation to one of constant potential.

If, upon running the finished machine, it is found to give too low a potential, owing either to an error in calculation or to the copper having a higher resistance than was assumed, a change in the speed will correct the potential for that load; but the machine will then no longer have a constant potential, as a change in speed alters the required proportion between the series and shunt coils.

If it is desired to make final adjustments or to allow for slight errors in calculation, or for certain small changes of speed, the shunt coils may be so calculated as to have a somewhat smaller resistance than would otherwise be necessary, and then there may be included in its circuit an adjustable resistance. This will enable one to adjust the shunt coils. To adjust the series coils, they must be calculated for a somewhat smaller current than otherwise, and an adjustable resistance placed between the terminals of the series coils so as to shunt off a portion of the current. By this means both series and shunt coils can be adjusted or varied between certain limits, thus avoiding the necessity of great accuracy in calculation. This also allows for the correction of small unavoidable errors, and for adjustment for a slightly different speed. These adjustable resistances, after being set by experiment to their proper values, need no further alteration. From the different functions of the two coils it can readily be seen which of them requires to be varied in adjusting the machine.

In conclusion, let us examine the diagram, Fig. 5 (ELECTRICAL WORLD, May 1, p. 198) again, in order to see what are the best proportions for a good compound machine. As the curve of magnetization $a\ c$ should be as straight as possible, the magnets should be of as soft a quality of iron as possible, and should just begin to be saturated with the maximum load. They should, therefore, be large enough, and there should be no great resistance to the lines of magnetic force by a scant allowance of iron at any part of their circuit. The magnets and iron should, of course, be arranged as economically as possible as regards utilization of the field.

As the armature resistance increases, the angle which the line $g\ h$ makes with the horizontal increases, and hence also the number of series coils; in this case the deviation of the curved line $g\ h$ obtained from experiment and the straight line assumed, becomes greater, and hence also the deviation of the finished machine from a constant potential one. From this it is seen that it is desirable to have the armature resistance as low as practicable, and, therefore, the field more intense, up to a certain limit. A Weston machine, exhibited at the Philadelphia Electrical Exhibition in 1884, had an armature of such low resistance that it had very nearly a constant potential without the use of any series winding. It is a question whether this is not the other extreme; that is, whether it would not have been more economical, as regards cost of material and construction, to make the machine somewhat smaller with a correspondingly higher armature resistance and a few series coils, at the same time letting the machine have the same efficiency and capacity; for, what is lost in the armature may be more than compensated for by the less intense field.

As the self-induction of the armature increases the sparking, it is well to have as few turns per coil on it as possible and a correspondingly large number of commutator strips or coils.

As the magnetic lag of the iron in the armature increases the difficulty of making the machine one of constant potential, this should be as small as possible, of the softest quality, and the number of windings on it as small as practicable.

As it is very desirable not to have to shift the brushes, everything possible should be done to avoid sparking and change of position of the line of commutation; or, what is the same thing, to avoid having to change the position of the brushes. Therefore, in addition to what has been said, the field should not be unbalanced, that is, the iron and coils should be so distributed that the field is symmetrical on both sides of the armature.

Lastly, great care should be taken in constructing compound machines, for if an error or fault shows itself, it cannot be corrected as readily as in other machines by merely changing the speed, coil resistance, or position of brushes, for these changes will change the compounding of the machine, so that it will then no longer have a constant potential.

Although it may hardly seem credible, yet the case has actually occurred in quite a large factory, that magnets were re-wound because the "direction" of the winding of the coils was not correct. It may, therefore, not be out of place here to remark that it is evidently quite immaterial in which direction the magnet coils are

wound, as they can in all cases be connected correctly with each other and the poles of the machine. It is evident that there is only one right way and one wrong way, and if a certain connection is wrong it is evidently only necessary to reverse the connections of the two ends of that wire to make it right. The only advantage in winding a certain definite way is that the connections may then be as short as possible and have a better appearance.

It is always advisable in making the test for determining the proper ampère windings, to examine the pole pieces as regards their polarity, with a compass needle (being careful not to reverse the polarity of the needle in doing so), and to note it so that the coils of the finished machine may be connected so as to have the same polarity. Also find which is the positive and which the negative brush in the test, so that the compound connections may be made correctly before the machine runs, as much time can thereby be saved; for it is evident that with certain connections of the magnets with the brushes, the machine will give absolutely no current.

NOTE.—In discussing the subject of the saturation of magnets, in one of the earlier articles of this series, the constant 250 was given as representing, for a particular case, the number of ampère windings passing around a magnet for square inch of cross section of the core when just saturated. It was omitted to state, however, that this constant applies only to such forms of machine magnets as are in general use, and that for certain less frequently used forms it will be some multiple or fraction of this, as will be seen from the following :

Every wire conveying a current around a magnet is encircled by lines of magnetic force, of which those that pass through the armature are rendered useful. In following the course of these lines it will be noticed that most of those generated by one of the two magnets of, for instance, an Edison machine, must return through the core of the other magnet, or in other words, each coil tends to saturate both of the cores of the magnets. This may be more readily explained by the fact that the two magnets of an Edison machine are really the two parts of one and the same U magnet, or they may be considered as one bar magnet bent at its middle to bring the two poles nearer together. In the same way a Weston machine may be said to consist of two such U magnets with their two north poles terminating in one pole piece and the two south poles in the other. This is also the case with the Brush, Jenney, Crompton, Siemens, Schuckert and many other machines with four magnet coils. The Thomson-Houston, Van Depoele, Hochhausen and like types may also be considered as magnetically equivalent to a pair of U magnets with the coils wound around the two pole pieces which the magnets have in common. The Mather type is quite different from these in this respect, as the entire U magnet is wound with wire. Another distinct type is found in the McTighe machine, in which the two U magnets contain each only one coil at what is frequently called the neutral part of the magnet. It might be compared to a Weston machine in which the two coils of each of the U magnets were placed together as one, on the end pieces or supports, or so-called neutral parts of the two magnets.

The saturation constant above referred to would therefore be quite different for some of the less frequently used types of magnets, unless it is taken as expressing the number of ampère windings on one whole magnet (from pole to pole) divided by the cross section of the core of that magnet, or, in other words, if it expresses the allowable number of ampère windings on one whole magnet per square inch of core. If used in this sense it ought to be about the same for all types of magnets, and would evidently be about twice as great, or about 500 for a Weston type of machine.

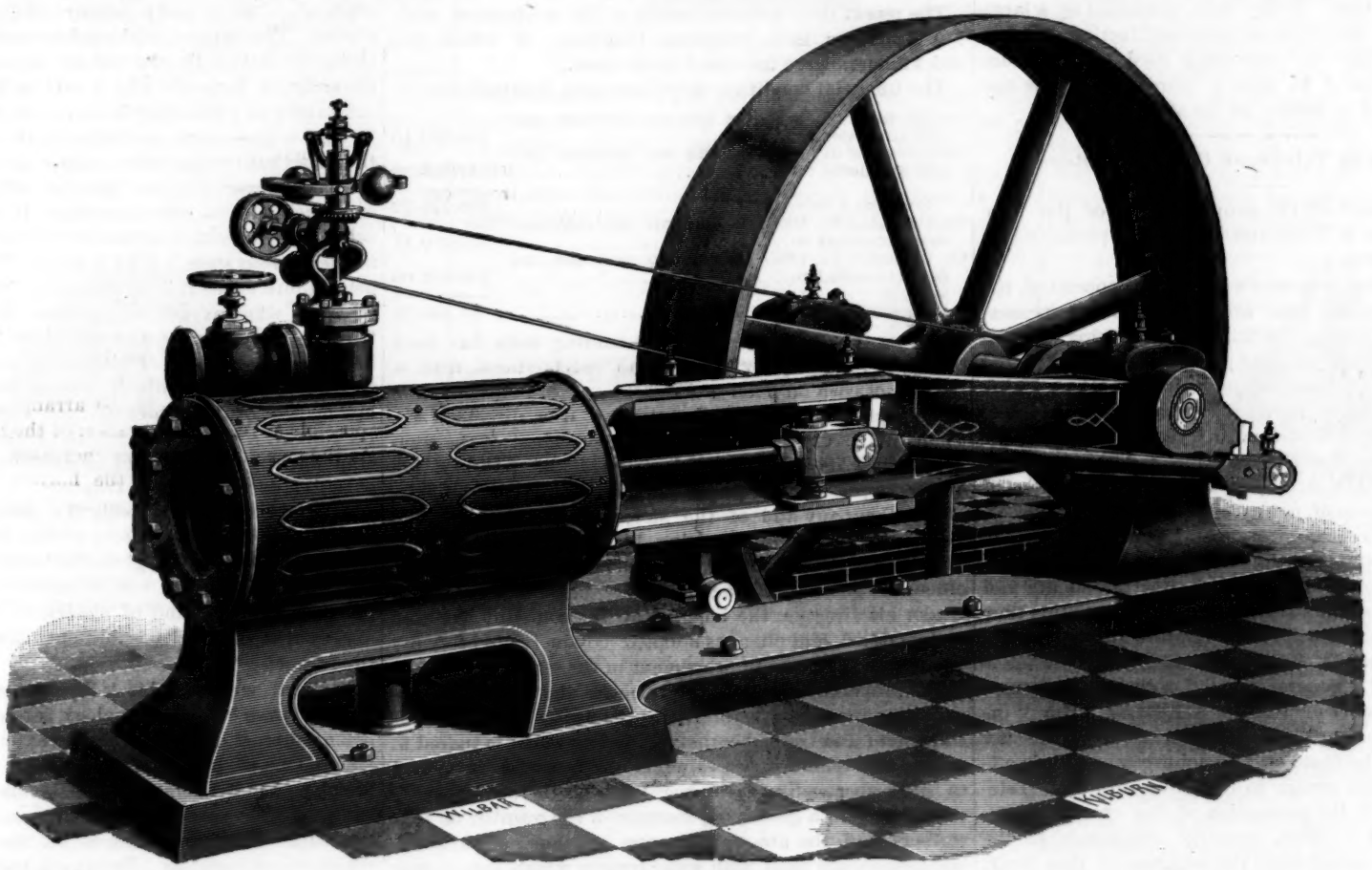
As iron becomes saturated when a certain amount of magnetism passes through every square inch cross section, a better saturation constant than the one used here would be the number of lines of force which may be passed through every square inch cross section of core at saturation. This would overcome the objection to using the number of ampère windings per square inch, as the latter is not the same for all sizes of coils, which is due to the fact that as the area increases the intensity of magnetisation diminishes for the same current.

The constant mentioned in the earlier part of this series of articles, may however, be safely used, if, as described there, it is determined in each case. It will be found preferable to the other one just suggested, as it simplifies calculations.

It will readily be seen from what was said here about the different types of machines, that if the constant were 250 for the Weston type, it would, if other conditions were eliminated, be 250 in the Thomson-Houston type and 500 in the Mather and McTighe types.

The Exeter Steam Engine.

While the automatic cut-off steam engine is deservedly popular, there are many situations in which the higher degree of skill required to run them successfully cannot be obtained, and hence a simple and economical engine provided with a good governor is often in demand, especially for electric lighting purposes. Such an engine has recently been designed and is known by the name of "The Exeter." As our illustration shows, the engine bed is of cast iron and extends from the outside end of the cylinder to beyond the main bearing, both being firmly bolted to it. The double girder casting which contains the cylinder, main bearing and the cross-head guide in one piece forms a rigid connection between the two former.



THE "EXETER" ENGINE.

At each end of the cylinder there is a double set of ports, the valve being double and connected to the rocker-shaft by a steel valve rod. It will also be noticed that the guide shoe-horn containing the wrist-pin is provided with adjusting screws and jam-nuts by which the piston rod can be lined up perfectly true.

This engine, for which Messrs. Frenyear & Razee, of Boston, are agents, is provided with all composition stuffing boxes and bushings wherever necessary, and the cylinder is made extra heavy, so that it can stand several reborings without diminishing its working strength.

Various sizes of these engines are built, and they are also combined into double engines with two cylinders on one bed and running a single shaft.

This combination is not only a safeguard against a total breakdown, which would be especially disastrous in an electric light station, but acts as a regulator, giving steadiness of motion. Should one side of the engine become disabled it can be disconnected and the other side may for a short time be driven at an increased load until repairs are made. Thus a complete stoppage may be avoided in case of accident and a reserve engine is dispensed with.

A Street Car Run by Storage Batteries in Baltimore.

Some months ago a very successful experiment was made by Mr. A. H. Bauer, of the Electric Storage Company, of Baltimore, on one of the Daft motor cars, for the purpose of demonstrating the practicability of secondary batteries for street car propulsion. Since then Mr. Bauer has devised a novel system that can be applied to existing cars at a very small expense. An experimental car equipped with the system has been running for the past two months on an eighth-of-a-mile track at the Viaduct Manufacturing Company's place.

Unlike other experimenters, instead of using light-weight cars for his test, Mr. Bauer has attacked the problem from the opposite side ; that is to say, he has begun with larger weights than would appear in practice.

The car used is an old one loaned by the Union Railway Company, is 20 feet in length and weighs 5,400 pounds.

The equipment consists of two beams extending from one axle to the other.

These beams carry a motor, the armature shaft being extended and having pinions on each end which mesh into counter gears. The countershaft carries a pinion, which in turn meshes into a gear on the car axle. The motor is wound in three sections in multiple arc, and is connected with a double switch located on the platform for throwing one, two or three of the sections in circuit with the battery, as desired, depending, of course, upon the amount of power the motor is required to develop.

To accommodate the batteries, which are placed under the seats and are entirely out of sight, the body of the car is raised three inches, so as to bring the wheels below the floor.

The batteries are set on trays upon rollers, and when necessary to make changes they can be run out on to platforms through doors in the sides of the car, and freshly charged ones run in. This can be done within the time required to change horses. Access to the motor and gearing is had through a trap-door in the floor, or they can be got at from underneath the car.

The weights of the different parts of the experimental car are as follows :

	Lbs.
Car	5,400
60 cells battery	5,400
Motor	923
Gearing	900
Total	12,623

or about 5⅓ tons.

In practice the above total weight will be reduced to about 7500 lbs.

The whole car, internally and externally, has nothing whatever strange in its appearance ; it looks indeed similar to an ordinary street car propelled without horses or other visible motive power.

The track is one-eighth of a mile in length, beginning at the car-house at the foot of a 1 in 20 grade, 200 feet in length, on a curve of 45 feet radius. As already stated, this car has been running almost daily for the past two months. With the exception of a bolt or collar, working loose, not a single fault has developed, the car running smoothly and satisfactorily during every trip.

When running at a speed of 6 miles per hour the armature makes 800 revolutions per minute.

With 5,400 pounds of battery the car will run continuously for six hours at a speed of 6 miles per hour, or a total of 36 miles.

These batteries are now being exchanged for the same number of half horse-power cells, having a total weight of 2,580 pounds. Calculation shows that with these the car should run continuously for three hours, or a total of 18 miles, before requiring changing.

Tests for determining this will be completed within a few days.

The cost of propelling cars with storage batteries depends almost entirely on the life of the batteries.

In the absence of information as to the depreciation when used on street cars, we can only base an estimate on the performance of those in use for other purposes.

An installation made May 1, 1884, for supplying 255 incandescent lamps, at the Baltimore Academy of Music, and which has been in daily service for over two years, is to-day in as good condition as when set up. This, coupled with two months' experience had on the experimental car, would indicate that the batteries should do service for two years on street cars. Calculations based on the efficiency of the above-mentioned installation show that the cost of running a line of street cars equipped with the Bauer system should not exceed $2.21 per car per day. The average cost of horsing is $4 per car per day. Given a line running, say, 24 cars, it will be seen that by substituting this system a saving of $1.79 per car per day is had. This for 24 cars amounts to $15,680 per annum, which, at 6 per cent., is the interest on $261,340. The system devised by Mr. Bauer appears perfect in all its details, not a single change having been found necessary up to the present time. It has been examined by a large number of people, who express great satisfaction and predict success. As the car now being used is rather unsightly, it is intended to have a more presentable one fitted up and placed in service on the streets.

The New England Telephone Company's Report.

Below is an abstract of the annual report of the New England Telephone & Telegraph Company, presented at the meeting last week:

As shown by the treasurer's statement appended, the gross earnings for the year are $920,841.38; expenses, $697,024.62; net earnings, $223,816.76. Owing to the change in the financial year the previous report exhibited the results of the business of only nine months. Using the figures of these nine months as a basis upon which to make up the earnings of the entire year 1884, a comparison of results gives for the year 1885: An increase of gross earnings of $12,592.31; an increase of expenses of $3,729.93; an increase of net earnings of $8,862.38.

The apparent increase of "general expense" is due to charging this account, for the later months of the year, with half the amount of salaries of superintendents and exchange managers. In the classification of accounts now adopted, these salaries will be charged in full as part of the exchange expenses.

The aggregate of "general" and "operating" expenses shows a relative yearly decrease of $11,861.83. The "insurance and tax" account is largely increased by the tax of $31,000 paid to the State of Massachusetts. This is offset by the decrease in rentals to the American Bell Telephone Company. If the proportion of the cost of reconstructing the Boston office, properly chargeable to the year 1884, were deducted from the earnings of that year, the net results for 1885 would show a gain of about 6 per cent.

A condensed statement of the construction and reconstruction for the year is given, which shows that in the process of the entire work upon exchanges and public lines there have been used: Of 180 wire aerial cable, 16,090 feet; of 50 wire aerial cable, 37,925 feet; of 25 and 20 wire aerial cable, 4,592 feet; of submarine cable, 1,780 feet; of 100 wire underground cable, 4,696 feet. Total 65,083 feet.

New poles, 5,562; wire, copper, 307 miles; wire, iron, 598 miles; total, 905 miles. The total amount of cable now in use is 145,932 feet, carrying about 1,600 miles of copper conductors.

The expenditure upon the plant during the year has been: For construction, $89,823.01; for reconstruction, $58,988.23; for repair, $114,930.83; total, $233,742.07. Of the above amount charged to construction, $27,642.67 was paid for work completed in 1884, and is more properly chargeable to the account of that year.

At the time the company was organized the delusion still existed, even in the minds of competent telephone managers, that, at the prevailing rates, the business of companies operating exchanges was highly profitable; and while all, and more than all, of the revenue was at once absorbed by the operating expenses and the cost of the plant, in many of the companies much too large a proportion of the expenditure was charged as development, new capital was called in and large dividends paid. It was inevitable that with the adoption of conservative methods, the actual results of the business should prove disappointing to those who had invested in the confidence of large returns.

The prospective profits of this company were largely overestimated, and within the first year of its existence the necessarily large expenditure for the maintenance, improvement and extension of the plant had forced upon the directors the conviction that the cost of conducting the business was, and must continue to be, largely in excess of what had been anticipated, and that the schedule of rates for subscribers must be revised in order that even a moderate return should be realized by stockholders upon their investment.

Before the close of the year the rates in all exchanges, except a few unimportant points, were established in conformity with a new schedule, which while operating, as a rule, to advance the rates, leaves the amount paid by many subscribers unchanged, while with some it has effected a slight reduction.

During the year there has been a decrease of nearly 3,000 in the number of exchange subscribers, principally due to the change of rates and the closing of unprofitable exchanges. The larger number of those who withdrew had been receiving service at rates involving constant loss to the company. The immediate effect was a decrease in gross revenue, which has been more than offset by the lessening of the expenses of operating, the cost of maintaining lines, instruments and batteries, and royalties upon instruments. Within the year several of the superintendents' divisions have been consolidated, and a general reorganization made in the staff of employés. By these changes and the closing of unprofitable exchanges, a considerable decrease in the pay-roll has been effected.

In January, 1884, a dividend of $73,395 was paid. Since that date and until the present year no dividend has been declared, the large amounts applied to extension and improvements having left no funds available for the purpose. In February, 1886, a dividend was paid from the earnings from the previous quarter, amounting to $52,500.

The report then gives the result of the conference with the American Bell Telephone Company, of which the stockholders were informed at the time.

The financial condition of the company is satisfactory.

On December 31, 1884, the bills and accounts payable amounted to	134,509.10
On December 31, 1885, the bills and accounts payable amounted to	47,763.38
Showing a decrease of	$86,745.72
On December 31, 1884, the accounts receivable and cash amounted to	131,930.41
On December 31, 1885, the accounts receivable and cash amounted to	139,873.63
Showing a gain of	$7,943.22

During the present year the remaining note has been paid, and the company has now no indebtedness, with a balance of cash on hand of $70,000.

In September last, to the regret of the directors, Mr. Theodore N. Vail, who had been the president of the company since its organization, resigned the position, his duties as president of the American Telephone and Telegraph Company and of the Metropolitan Telephone and Telegraph Company requiring his presence most of the time in New York. Mr. J. N. Keller was appointed to the office of general manager at the beginning of 1885. Under his direction the business of the company has been systematized, and changes adopted conducive to economy of management and improvement in the service.

The property, as a whole, is in better and more effective condition than ever before. The company has a corps of competent and trained employés, and no effort is spared to extend and render more valuable the facilities furnished to subscribers. Since the beginning of the present year there has been a gratifying increase in the number of subscribers and the amount of gross revenue. Unless the business should meet with some reverse which cannot now be foreseen, the directors have reasonable confidence that the profits for the year will not fall below the amount necessary to provide for the quarterly dividends, as set forth in the circular of January last.

Alleged Proofs that Electricity is an Element.

To the Editor of The Electrical World:

SIR: In the year 1882, you published a letter of mine containing particulars of experiments which led to the conclusion that electricity is a kind of matter, which, although it does not gravitate, yet it seems to be the medium through which gravitation acts on common matter. I hope you will allow me to lay before your readers some facts which establish the accuracy of the above conclusion.

(1). Professor Dewar has proved that oxygen gas is a transparent, colorless fluid when exposed to a temperature of —130° C., and under a pressure of between 80 and 100 atmospheres, and also that liquid oxygen does not act on sodium, potassium, phosphorus, hydrogen and other reagents.

(2). MM. Hautefeuille and Chappius proved by experiments that ozone, at the temperature of —23° C., and under a pressure of 75 atmospheres, is a liquid of an azure blue color.

(3). All the modern books on chemistry assert that ozone is condensed oxygen.

(4). Professor Dewar found that the low temperature of —130° C. and pressure of 80 to 100 atmospheres was incapable of condensing oxygen into ozone. Therefore something still more powerful is required in order to condense oxygen into ozone.

(5). According to all modern books on chemistry, three volumes of oxygen gas are condensed into two volumes by their conversion into ozone; namely, that "ozone is oxygen existing as a triatomic molecule." Is this the truth? Yes; but it is not the whole truth. It takes something more than oxygen to make ozone, but this something is not allowed to have an existence according to books on chemistry.

(6). When a frictional electric machine is set in motion the peculiar smell which arises is caused by the free electricity acting on the oxygen of the air and converting it into ozone. And when scientists wish to make ozone in considerable quantity they pass oxygen gas through a tube which is kept electrified positively, namely, at that which is called a high potential, and the gas which goes in at one end of this tube as oxygen comes out at the other end in the form of ozone. In other words, a supply of electricity is required to condense oxygen into ozone.

(7). If ozone gas be shaken within a glass vessel containing some powdered glass, the electricity which the oxygen had absorbed to convert it into ozone leaves the ozone and goes into the powdered glass, and the ozone expands into and becomes oxygen gas. This process of making a portion of oxygen gas to alternately condense into ozone and again expand back into oxygen by alternately adding and subtracting the necessary quantity of electricity may be carried on indefinitely. In other words, we can make ozone synthetically by adding an element to oxygen, and we can decompose ozone analytically by subtracting the said element. Yet, according to all the books on chemistry hitherto published, the element in question is not granted to have any existence. It is looked upon as being merely a mathematical quantity.

(8.) Look now at the enormous difference there is between oxygen gas condensed into ozone by means of electricity and oxygen gas converted into a liquid by the low temperature of — 130° C. and a pressure of from 80 to 100 atmospheres. The oxygen condensed by the means of adding electricity acts with enormously increased powers on all the ordinary reagents, and it acts so powerfully on such substances as vulcanized india-rubber that if a tube of it be used to pass ozone gas through, the ozone soon destroys the tube; but oxygen alone cannot do this, and when oxygen is condensed into the liquid state by low temperature combined with enormous pressure it loses all its power to act on the common reagents on which it acted so well when in the gaseous state. Why is this? When oxygen is condensed into ozone it is by means of electricity added to it; whereas, when oxygen is converted into a liquid by low temperature and great pressure, there is good reason to believe that the amount of electricity which oxygen held in the latent form, while it was in the gaseous state, is crushed out of it in order that the oxygen might go into the liquid state, and that it is the reduced quantity of electricity within the liquid oxygen which makes it incapable of acting on the common reagents.

Although it is undoubtedly the extra amount of electricity which becomes latent within the oxygen and converts it into ozone, and gives the latter its increased power of acting on reagents, yet scientists will not admit that ozone is a compound of electricity and oxygen. Their theory that electricity is a nonentity is contradicted by the foregoing facts.

Maxwell wrote in his "Elementary Treatise on Electricity," page 8: "The analogy between temperature and potential must not be assumed to extend to all parts of the phenomena of heat and electricity. * * We must remember that temperature corresponds to a real physical state, whereas potential is a mere mathematical quantity, the value of which depends on the point of reference which we may choose. To raise a body to a high temperature may melt or volatilize it. To raise a body together with the vessel which surrounds it to a high potential, produces no physical effect whatever on the body." Is this true? In order to convert oxygen into ozone the tube through which the oxygen passes requires to be kept at a high electric potential, and it is because it is so kept that the oxygen passing through the tube absorbs electricity, and the oxygen is thereby converted into ozone, which fact is the very opposite of Maxwell's statement that "a high electric potential has no physical effect on the body" —the oxygen. Although electricity may not gravitate, yet it has the power of causing common matter, such as oxygen, to cohere and condense, so that three volumes of oxygen are crushed into two volumes, which we call ozone, and hence electricity must be an element.

There is another interesting matter in connection with this subject. When MM. Hautefeuille and Chappius attempted to condense ozone gas into the liquid form, they found that the ozone exploded in the glass tube they were condensing it in when the temperature was allowed to rise higher than —23° C., and at the same time the explosion occurred a flash of yellowish light appeared within the tube.

These scientists did not attempt to explain these phenomena, but there can be only one cause for the explosion, namely the sudden decomposition of the ozone. Its latent electricity having suddenly left it, two volumes of ozone would instantly become three volumes of oxygen, hereby producing the explosive force. Now arises the question, What induced the latent electricity to leave the oxygen? As the rise of temperature was the primary cause of the explosion, it must have been the increased quantity of heat within the tube which attracted the latent electricity and took it away from the ozone, and if so, then we know

that it must have been the union of the extra heat with the latent electricity which produced the flash of light within the tube. JAMES JOHNSTONE.

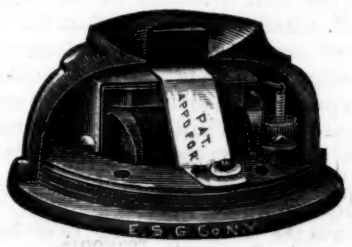
8 MERCHISTON PARK, EDINBURGH, April 3, 1886.

An Electric Log.

A San Franciscan named Bernard Faymonville, has invented an electric log, which is described as follows by the San Francisco *Call*: "The log consists of a brass cylinder, with four blades or fins. The cylinder revolves on its swivels, practically frictionless, and in turning acts upon a small cog-wheel inside, which causes a short interior cylinder to turn, and every ten revolutions breaks the circuit. The battery is on board the ship, and the register or indicator is placed in the captain's cabin, or anywhere convenient or desirable. There may be several registers distributed for convenience over the vessel. The wires for the outward and return currents are attached at one end to the register and the other to the log, which is dragging behind the ship. Ten revolutions break the circuit, and the mile hand on the dial of the indicator registers one-tenth of a mile passed over, and one passage of this hand around the dial denotes a mile of distance, and another hand moves forward one-tenth of ten miles. It passes around the dial once in ten miles, and the third and shortest hand passes around in one hundred miles." The apparatus has been tried and is said to work well in practice.

A Novel Indicating Push-Button.

It is a great satisfaction to most people to know that when they push a button an actual signal has been transmitted, and that the circuit is in working order. The ordinary push button does its work so silently at the calling end that no indication is given whether the current has passed or not, and hence the person calling has no guarantee that his signal will be received. To remove all such doubt Messrs. E. S. Greeley & Co., of this city, have designed the push-button shown in the accompanying illustration. This contains within its case a "buzzer" which responds to each make and break at the call-bell. Hence, an audible sound is produced when the button is pressed, which indicates that



AN INDICATING PUSH-BUTTON.

the circuits are in order, while an absence of the sound shows that something is wrong.

American Institute of Electrical Engineers.

The second annual meeting of the Institute for the election of officers and the transaction of other business will be held at the house of the American Society of Civil Engineers, 127 East Twenty-third street, New York, on Tuesday, May 18, at 8 P. M.

A general meeting for the presentation of papers and discussion of the same will convene at 10 A.M., on Wednesday, May 19, and continue through the day. A collation will be served during the recess between the sessions, on Wednesday. The following papers will be read: "Underground Electrical Systems," Sidney F. Shelbourne; "Secondary Batteries for Lighting and Power," A. H. Bauer; "Recent Progress in Telephony," Thomas D. Lockwood; "Incandescent Lighting from Central Stations," H. M. Byllesby; "Review of Patent Office Practice," A. C. Fowler; "Experience in Practical Use of a Standard Tangent Galvanometer," Prof. W. A. Anthony; "Static Difficulties in Multiplex Telegraphy." F. W. Jones. Those who intend being present on Wednesday will confer a favor by notifying the Secretary, Mr. Ralph W. Pope, 11 Wall street, this city.

Metallic Couples in Saline Solutions.

Mr. B. C. Damien, in a paper on the E. M. F. of current yielded by metallic couples in simple saline solutions, according to an abstract in the Chemical Society's *Journal*, finds, from a large number of determinations that the E. M. F., as a rule, decreases with the time the couple is immersed. In the case, however, of the zinc copper couple in solutions of the chlorides, the E. M. F. at first slowly increases. The E. M. F. of the current yielded by a zinc copper couple in a solution of magnesium sulphate is very constant, scarcely varying 0.017 volt during 12 months, and is not appreciably affected by changes either of the strength of the solution or of temperature. By introducing an exterior resistance of 20,000 ohms, the current becomes practically invariable even when the couple is kept in circuit. The author proposes to employ this couple for the generation of currents of standard strength. The zinc copper couple yields currents whose E. M. F. is almost identical for members of any class of salts containing a given acid, but varies greatly with a change of acids; amalgamation of the zinc slightly increases the E. M. F. at first, but it decreases more rapidly than is the case when unamalgamated zinc is employed. The current obtained from a platinum and amalgamated zinc couple in dilute sulphuric acid has its maximum E. M. F. when its solution contains 30 per cent. of acid.

Electric Light Reflectors.

Simultaneously with the introduction of the electric light the question of its proper distribution became of importance, the more so as it lends itself with great ease to dis-

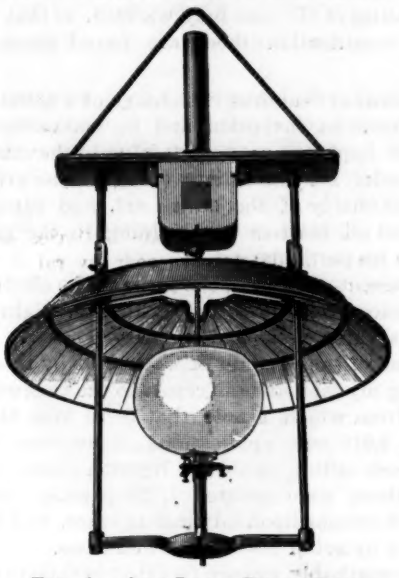


FIG. 1.—ARC LAMP REFLECTOR.

positions which would be out of the question with other illuminants. Still, it may be truthfully said that even at the present time much light is wasted, *i. e.*, thrown in directions in which it is not required. A suitable system of distributors or reflectors would enhance considerably the value of many electric lights, either arc or incandescent,

FIG. 2.—INCANDESCENT LAMP REFLECTOR.

and with this idea in view the Wheeler Reflector Company, of Boston, has brought out several forms of reflectors which have been designed so as to give a uniform intensity of illumination, and to intercept the rays which usually go off uselessly into space. Our illustration, Fig. 1, shows an arc light reflector for lighting a circular area of a diameter

FIG. 3.—CLUSTER REFLECTOR.

equal to twice the height of the reflector above the ground. The diameter of the reflector is 32 inches, and it seems well adapted for large enclosed spaces and for tower lighting. Figs. 2, 3 and 4 represent various forms of reflectors adapted to incandescent lamps, singly and in clusters.

The reflectors are made of heavy tin and lined with crystal glass, which is plated with silver. This is well protected by a coating rendering it impervious to moisture, gases or other influences. For uses where greater ornamentation is desired, polished brass, nickel or copper shells are substituted for tin, and in this way reflectors can be introduced into interiors where ordinarily they would not be admitted.

In addition to the forms shown, the company also manufacture a reflector which is eminently adapted to be used with arc-lamps employed for street lighting. They are so arranged as to throw the light longitudinally in both directions parallel with the street.

On the Cause of the Solar Diurnal Variations of Terrestrial Magnetism.

At a recent meeting of the Physical Society a communication entitled as above was read. The author, Prof. Balfour Stewart, began by reviewing various theories that have been advanced to account for the solar diurnal inequalities of terrestrial magnetism. That they can be due to the direct magnetic action of the sun is highly improbable, since terrestrial analogies would lead us to infer that matter at the temperature of the sun is quite incapable of possessing magnetic properties, and also from the fact that changes in the range of the daily variation lag behind corresponding solar changes in point of time. The hypothesis of Faraday, that the observed variations are the result of the displacement of the magnetic lines of force due to the varying temperature, and consequently varying magnetic permeability of the atmospheric oxygen, is disproved by the fact that there is no agreement between the chief magnetic variations and those of the temperature of the great mass of the atmosphere, though it is certain that there must be some effect due to this. The earth-current hypothesis is quite unable to explain one of the chief characteristics of these variations, that they are half as great again at periods of maximum as at those of minimum sun-spot frequency; Sir George Airy has, moreover, been unable to detect any resemblance in form between the regular diurnal progress of the magnet and that of earth currents. One seems, therefore, compelled to seek for the cause of the variations in the upper atmospheric regions, and he could not imagine such a cause to exist in any other form than that of a system of electrical currents. That currents may, and actually do, exist at great heights is shown by the aurora, which is unquestionably an electric current and manifests a close connection with the phenomena of terrestrial magnetism. The great increase of magnetic variation at epochs of maximum sun-spot frequency can also be accounted for on this supposition. Prof. Stokes has remarked that an increase in the radiating power of the sun would probably imply, not only an increase in general radiation, but a special and predominant increase in such actinic rays as are probably absorbed in the upper regions of the earth's atmosphere.

FIG. 4.—INCANDESCENT LAMP REFLECTOR.

These regions will, therefore, greedily absorb the new rays, their temperature will rise, and, as is known to be the case for gases, the electrical conductivity will be increased. Thus, even if we imagine the general atmospheric current to remain constant, a greater proportion of it would be thrown at such times into those heated portions which had become good conductors, but it is also probable that the current itself would be increased. Assuming the existence of currents at great altitudes, the regularity and general characteristics of the diurnal variations would seem to point to a direct magnetic action of the currents, rather than to any general induced change in the magnetic system of the earth, which, to produce the observed results, would have to be of a very artificial character. The diurnal variation of the declination, attaining a westerly maximum at 2 P. M., north of the equator, and an easterly maximum at the same time south of it, would suggest the existence of currents flowing northward and southward from the equator to the poles, attaining a maximum in each hemisphere about two hours after the sun had passed the meridian. To supply this flow we should probably have to assume the existence of vertical currents ascending from the equatorial regions of the earth. At this point Dr. Schuster had endeavored to apply mathematical analysis to the subject. From the recorded observations at Greenwich, Lisbon, Hobarton, St. Helena and the Cape, he has shown that the work done by a magnetic pole describing a closed path in a horizontal plane at those places is equal to the work done upon it, and consequently no part of the ascending current can be inclosed by the path. Hence the potential at those places obeys the law expressed by the equation

$$\frac{d}{d}\frac{v}{x^2} + \frac{d^2}{d}\frac{v}{y^2} + \frac{d^2}{d}\frac{v}{z^2} = 0.$$

From this, Dr. Schuster has deduced two possible expressions for the potential, one referring to a system of currents above our heads, and the other to one beneath our feet. From the first of these expressions it follows that for latitudes greater than 45°, the maximum of horizontal force should coincide with the minimum of vertical force, and *vice versa*, and this is actually the case at Greenwich, while the opposite should hold if the influencing system were beneath us. For latitudes below 45° the reverse of the above should be the case, and the observations at Bombay, though less decided than those at Greenwich, would seem to point the same way. On the whole, then, it must

be said that the results of the first attempt are very encouraging, and point to the supposition that the greater part of the disturbing cause lies outside the earth's surface.

In a discussion that followed, Mr. Whipple remarked that recent observations in high latitudes seem to show that the aurora is not always at such a great height as is usually supposed. Prof. A. W. Rücker cited the well-known case when an observer saw what appeared to be a meteor fall into the sun, while simultaneously, or nearly so, there was recorded a magnetic disturbance on the earth, as showing a direct solar action. Mr. Whipple, however, stated that he had recently examined this point, and believed that the very slight notch in the record, many similar to which have occurred since, was of an accidental nature, and a mere coincidence.

Professor McLeod suggested that the earth-current theory might be tested by observations at the bottom of a mine, where, according to the theory, the disturbances should be reversed.

Professor Adams believed that there was nothing physically impossible in the existence of such currents as the author imagined.

History of the Electrical Art in the United States Patent Office.*

BY C. J. KINTNER.

I once heard a member of Congress say to some of his constituents who were doing Washington City, from the tourists' standpoint: "Go first to the Smithsonian Institute, where you will see all that God ever made; go thence to the Patent Office, where you will see all that man ever made."

The advice, although given in jest, contained, at least so far as the Patent Office is concerned, much more truth than the speaker imagined.

The American patent system virtually dates its origin from the Constitution, in the eighth section of the first article of which our forefathers inculcated these words:

"Congress shall have the power to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

Out of this grew legislation concerning patents as early as 1790, when the first revised statutes became law.

No organized system of granting patents was developed until 1836, when the Patent Office sprang into existence, and the law was amended so as to develop substantially the system in vogue to-day. From that time to the present, just a half century ago, there have been no material changes in the revised statutes, and there has resulted from this wise legislation the most wonderful advance in the arts and industries the civilized world ever knew.

In the Patent Office we recognize and protect by patent all inventions and discoveries coming under any one of the following classifications: (1) an art; (2) a machine; (3) an article of manufacture; and (4) any improvement upon any one of the foregoing.

One principal examiner has charge of each art and is supplied with from four to eight assistants, dependent upon the demands of his art.

The electrical branch of the office prior to 1881 embraced one sub class known as class 36, electricity, under the division of philosophical instruments. In that year the rapid growth in the matter of electrical inventions made it necessary to make a new classification, and philosophical instruments were taken by another examiner, electricity constituting an entire class, which has since become the most important art in the Patent Office.

The introduction of the telephone, based upon Alexander Graham Bell's patent, No. 174,465, March 7, 1876, gave a new and wonderful impetus to inventions in electrical appliances. There had been, prior to that time, marked progress in telegraphs, and much ingenuity had been displayed by inventors in simplifying the methods of telegraphic communication by developing apparatus adapted for use between inexperienced operators by automatic, stylographic and printing telegraphs, but when this new and wonderful invention sprang into existence it seemed to instill new life into the inventive genius of the world. Prior to 1876, less than 2,000 patents had been granted on electrical appliances of all kinds.

So rapid has been the development that each year necessitates new classification, and a thorough reorganization of the entire classification was effected during the past year, creating in place of one class, nine, as follows:

Class 171, *Generation.*—Embracing all kinds of apparatus for the generation of electricity.

Class 172, *Motive-Power.*—Including electric motors, transmission of power, etc.

Class 173, *Conductors.*—Including all means of conveying electricity from point to point, and all apparatus for in any way facilitating the transmission of current without interruption.

Class 174, *Medical and Surgical.*—Including all applications of electricity for sanitary purposes.

Class 175, *Special Applications.*—Having reference to all miscellaneous applications of electricity, such as are found useful in other arts, as dyeing, tanning, machinery, etc.

Class 176, *Electric Lighting.*—Having reference to all uses of electricity for illuminating purposes.

Class 177, *Signaling.*—Including all devices used for transmitting indications or alarms and signals for specified wants or needs, as burglar alarms, annunciators, railroad signals, etc.

Class 178, *Telegraphs.*—Including all methods and apparatus for transmitting information by codes.

Class 179, *Telephony.*—Embracing all appliances utilized in the transmission of articulate speech, whether by electricity or mechanical telephones.

Each of these classes is again divided into sub-classes as the necessities of the case may warrant, so that under the existing classification there are found about 100 sub-classes.

Each assistant examiner has charge of a definite number of sub-classes of invention, and he makes the examinations of all applications appertaining to the classes of invention under his immediate charge. The principal examiner has charge of the entire art, and supervises and passes upon all matters appertaining to the granting of patents in his particular art.

As at present organized, the force of the electrical division embraces one principal examiner, eight assistant examiners, three clerks and one stenographer. Some idea may be had of the amount of work done by this force by examining my late annual report to the Commissioner of Patents, from which I note that there were filed, during the year, 2,019 new applications; there were filed 3,679 amendments calling up old or rejected cases for further action; there were granted 1,320 patents; there were made 6,036 actions upon all kinds of cases, and there were abandoned by act of law 610 allowed cases.

It is a remarkably strange fact that in this, the youngest of the industrial arts recognized in the Patent Office, very few of the earlier inventions which note great advances were ever patented in this country.

We find that many of the very best batteries known in the art were the result of laboratory experiments made by such physicists as Grove, Bunsen and Daniell, and were never made the subject of patents in America.

So, too, with the earlier friction generators, the broad principle of reactionary generators discovered by Hjorth, and the broad idea of the division of the arc light as developed by Messrs. Lacassagne and Thiers as early as 1856.

We note, also, that Starr and King, of Cincinnati, O., took English patents for the broad idea of an incandescent lamp with continuous conductor in an exhausted globe as early as 1845, but never patented it in America.

The records of the Patent Office show that the first patent disclosing any electrical appliance whatever was granted in 1833, July 22, to D. Harrington, of Philadelphia, Pa., for an apparatus for curing diseases by electricity.

However commendable the inspiration may have been which led Mr. Harrington to thus offer aid to his suffering fellow-men, I cannot vouch for the efficiency of his apparatus, which consisted in applying two metals of different electrical potential to the body in such a manner as to generate an electrical current through the body.

Mr. Harrington took out two more patents on apparatus of a similar nature in the following years 1834 and 1835.

These three patents are all that are found upon the records in the art prior to the establishment of the Patent Office proper in 1836. The original records of them were destroyed in the great Patent Office fire of 1836.

The first patent granted under the revised law of 1836 was to Thomas Davenport, of Brandon, Vt., for an electro-motor on the 25th of February, 1837. [For description see E. W., Jan. 10, 1885.]

On the 27th of June, 1838, the first derived circuit motor was patented to N. Walkly, of Tuscaloosa, Ala. [See E. W., Jan. 10, 1885.]

At this stage of the history of the art, there comes upon the scene of action the first inventor of lightning rods who seems to have availed himself of the protection offered inventors by our patent system.

The first patent upon lightning rods was granted March 6, 1839, to Jos. S. Barber, of Gloucester, Mass., and to one versed in the peculiarities of statical electricity, the invention covered by it appears somewhat peculiar, and I may add, to be of doubtful utility. It consisted of a paraboloidal metal body, having its base attached to a wooden rod, the latter fixed at some elevated position above the structure to be protected.

Affixed to this paraboloidal body were several sharp points of metal projecting in all directions about it.

The inventor assumed that when a storm cloud approached, this metal shield would cause the bound electricity in the structure to be disseminated before the cloud reached a striking distance.

It is pretty generally assumed on the part of our countrymen that Prof. Morse was the first to patent the electric telegraph in this country.

This is a mistaken notion, as the records of the Patent Office show that Messrs. Wheatstone and Cook, of England, took a patent for their needle electro-magnetic telegraph on the tenth day of June, 1840, while Prof. Morse's patent followed only ten days later.

The Wheatstone and Cook needle apparatus consisted of several wires running to the distant or receiving station, in each of which was located a galvanometer adapted on closure of the circuit to cause a needle to vibrate to the right or left as desired.

This patent also embraces some features upon underground conduits, which are of general interest at present in view of the attempts to force conductors under ground.

So well known is Prof. Morse's invention that it is not necessary to offer any description here, but simply to note that the original models on file in the Patent Office take the first rank among such historical curiosities as the Howe sewing machine, the Jacquard loom, etc., etc.

It is very curious to note also that the models made by Prof. Morse are marvels of workmanship and proportion when we consider the fact that he was pioneer in the art, and labored under difficulties known only to a great inventor struggling against fate.

In 1842, March 28, the first patent was granted to Patrick Coad, of Philadelphia, Pa., for an improved galvanic battery for medical uses.

It is of no especial importance other than being the first galvanic battery protected by patent in America.

In 1846, April 11, we find the first printing telegraph patent granted to Royal E. House.

This application, which was the parent of a large class of inventions known as printing telegraphs, was followed in 1848, December 5, by Bain's automatic telegraph, which was destined to avoid the Morse patent heretofore referred to. It operated by or through the agency of an electrical current acting upon a circuit upon a paper made sensitive by a chemical solution. Out of this patent grew the famous suit, O'Reilly *vs.* Morse, in which the Supreme Court of the United States held Morse's eighth claim, which was in effect to the use of electricity for the transmission of intelligence, to be void.

The first patent upon a straight current magneto-electric machine bears date of Nov. 1, 1853, and was granted to Calvin Carpenter, of Pawtucket, Mass. It is substantially an Alliance machine with commutator arrangement for straightening or directing the current; the armature consists of a series of electro-magnets whose cores are exposed at both ends to the influence of permanent magnets arranged in front of them. The commutation of current is not substantially different from that in general use on this type of machines as now used.

I will now call your attention to the Page motor, patented by Prof. Charles G. Page, on Jan. 21, 1854. In this motor the two armatures consist of long cores of iron which are adapted to slide with an oscillatory motion through two pairs of solenoids made up of successive sections which are brought into action by sliding commutators actuated by rods from eccentrics on the fly-wheel shaft, being entirely analogous to the cut-off mechanism used in a steam engine.

This motor is the more interesting to us because its inventor was an acknowledged authority in electrical matters in his day, was the associate of Professor Henry, and the discoverer of what is known as the Page effect in the cores of electro-magnets. He was also one of the first examiners appointed in the United States Patent Office under the law of 1836.

On the 18th of May, 1858, Messrs. Collier and Baker took out the first patent granted by the United States for an improvement in the arc light.

It consisted of two electrodes of carbon; the upper carbon was prevented from making contact with the lower by a retaining diaphragm of metal through which its point projected.

It acted by a mercurial feed, the carbons being forced forward by the mercury in which they were immersed. As a practical lamp, it was not a success.

By a strange coincidence during the same year the first patent upon an incandescent lamp was issued to Gardner and Blossom, composed of a platinum coil inclosed in a glass chamber, but this containing chamber was not exhausted. [See E. W., Oct. 3, 1885.]

In 1859, on the 20th of September, the well-known Grenet battery was patented.

On the 26th of February, 1861, there was patented to Charles Kirchhof, of New York, an improvement in storage batteries which deserves special mention here. It stands out alone to-day as an invention at least twenty years in advance of its time, and the description and model are wonders of curiosity to those dealing with the question of storage batteries.

I venture to say that no one of the older patents in the art has been more generally quoted and appeared in the light of an annoying reference to those who imagined they were original inventors than the one under discussion.

It is the Planté type, composed of lead plates adapted to be charged as was Planté's battery. Kirchhof saw the necessity of increased surface for his electrodes, and to this end proposed many forms consisting of corrugated plates, wire netting, perforated plates, etc. He well understood the necessities of the case, and his specification discloses a knowledge of the art at once as wonderful as was his ingenuity in developing means of overcoming to him known difficulties.

He also developed an apparatus for charging each cell in succession while the charged cells were discharging upon an exterior working circuit.

I regret that I have not the model with me to show you the wonderful genius of an inventor who was developing an art destined to sleep nearly twenty years.

The next improvement in this line of invention was

* Abstract of a lecture delivered before the Franklin Institute.

patented to C. G. Percival, of Brooklyn, N. Y., on November 9, 1866. It consisted of a wooden battery cell divided into two chambers by a porous partition. In these chambers was placed powdered carbon or lead in such manner as to surround the electrodes.

This carbon or lead was saturated with dilute sulphuric acid, after which it was ready to receive the charge. This is the first storage battery having active material surrounding the electrodes.

On the 23d of April, 1867, a patent was issued to G. S. Leclanché for the famous battery now found with slight change in almost every telephone box in the land. It is too well known to need description here and stands as a land-mark in the list of useful inventions covered by patents.

(TO BE CONCLUDED.)

Talk About Telephone Men.

In its gossip of men about town, the New York *Tribune* has the following: "Theodore N. Vail, who is president of the Metropolitan Bell Telephone Company, as general manager for years of the parent Bell Company, at Boston, probably gave more direction to the organization of that enterprise into its present gigantic proportions than any other one man connected with it. He is a tall blond, with a portly presence, a large, solid, and shrewd face, light moustache and close-cut yellow hair. He is not yet fifty and possibly not forty-five. His connection with the telephone has brought him wealth, but not retirement or rest. He works hard when here, and is to be found at his office every day; but he is required at Boston, Philadelphia and Washington frequently on business of the parent company, although he retired from its management many months ago. I am told that the change was the result of his determination to force the company to a more liberal policy with its subscribers. He held that a policy that would lessen the yearly rental all over the country would bring the company such an increased business that its profits would be much increased. The opposition carried the day in favor of keeping the rates up to the top notch and getting all that was possible out of the patents during their life."

This is also given:

"General B. F. Butler told me yesterday that one of his most serious problems while Governor of Massachusetts related to the Bell Telephone Company. They had secured the passage of a bill in the Legislature to increase their capital stock to some $5,000,000 or $6,000,000. 'When I took the matter up for investigation,' said the General, 'I found that they had several times increased their stock or changed their organization. Each time the patents were put in as the principal capital of the company. Their statement of business was bad. The exhibit of liabilities figured up so that the profit and loss account was really an asset. I made up my mind that the increase was against public policy and had written out part of a veto message giving my views on the subject. I had sent for Mr. Forbes, the same gentleman who has been over to Washington, and had asked him for information, but could get no satisfaction out of him. I finally sent for the treasurer, who made an exhibit to me of the stockholders. I had supposed until then that the stock was held by four or five persons in Boston. I found to my astonishment that the stock was very widely distributed. It was held quite largely by trustees of estates, and I knew what that meant. If the investment proves a good one, the trustee calls it his personal investment and takes the proceeds. If it is poor the estate foots the loss. The stock was at 260. My message would have smashed the company, but I could not find it my duty to inflict injury on so many people, innocent people, and I folded up my partly written veto and let the law become operative by the lapse of ten days without my signature. I said to myself that the company would probably be pulled down some time, and all these people suffer, but I could not consent to be its murderer.' General Butler and Mr. Forbes have not been good friends, and it was just after he had decided not to veto the capital increase bill that a gentleman came to him one day and said: 'General, you have your opportunity now for a great public service and for a big hit for yourself.' 'How so?' asked the General. 'By vetoing the telephone bill. Forbes is one of the worst enemies you have ever had.' The General responded, 'Does it not occur to you that if I should veto the bill the people would say that I did it on that account alone?' It was then that he determined to let the bill become a law."

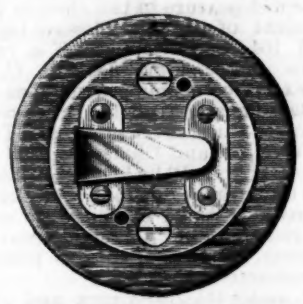
An Electrical Cat-o'-Nine-Tails.

A savant named Henri Roget, hailing from Lyons, has, it is stated, a new use for electricity. He has a patent to apply it as a substitute for the cat-o'-nine-tails in corporal punishment. The culprit having been undressed is securely strapped to a steel triangle, which is connected with one pole of a powerful battery. The other pole is connected with the whip, which consists of a number of steel wires covered with sponge. This whip is dipped in water before the stroke is administered, and wherever the wet wires touch an electric discharge takes place.

The inventor claims that the chastisement can be made so mild as not to injure a school girl, while, on the other hand, by increasing the power of the battery, a punishment can be administered beside which the knout would be mere child's play, and at the same time no injury is inflicted, the disgusting spectacle of a lacerated back is avoided, and the culprit, instead of having to be sent to the hospital to have his wounds healed, can be put to work in five minutes after the flogging is over. M. Roget intends petitioning Gen. Boulanger, the French minister of war, to allow his patent to be used experimentally on the next soldier sentenced to the cat. Flogging is not in existence in the French army, nor is it likely to be introduced to test the machine.

An Improved Push Button.

The push button is such a universal factor in domestic electric installations, and is so simple in operation, that improvement seems hardly possible. The usual form operates by the simple contact of two pieces without allowing of a variation of the point of contact. It happens not infrequently that in course of time, through corrosion,



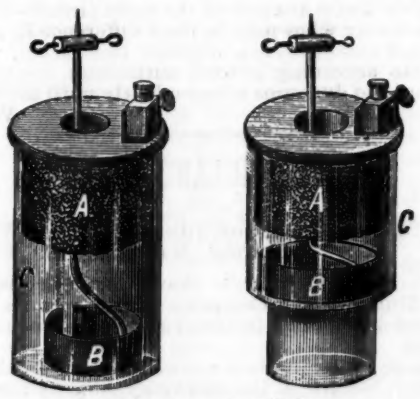
AN IMPROVED PUSH BUTTON.

dust or otherwise, the contact becomes imperfect, and causes trouble. To obviate this difficulty, Messrs. W. R. Ostrander & Co., of this city, have designed a push button in which a sliding contact is provided. Our illustration shows the interior arrangement. When pressed the knob depresses an arched spring, the end of which slides upon the other contact with every pressure. In this way the contact points are always kept bright, and the troubles above mentioned are avoided.

Pollak's Regenerative Cell.

This is the name which has been given to a battery which attracts attention on account of its simplicity of construction, the cheapness of the materials employed and the little attention which it requires. It differs in principle from other forms of battery in that it employs the air as a depolarizer to dissipate the hydrogen generated.

The element, which is shown in two forms in Figs. 1 and 2, consists of a glass jar, upon the bottom of which rests a cylinder of zinc, which constitutes one electrode. The other electrode is a carbon cylinder, which, though very



A "REGENERATIVE" CELL.

porous, is made to conduct well, and has a coating of copper deposited electrolytically upon its lower end. After the electrodes are placed in position, common salt or sal-ammoniac is put into the vessel, which is then filled with water up to about 3 or 4 centimeters above the lower end of the carbon.

At the beginning, local action takes place between the copper deposited on the carbon and the carbon itself, which decomposes the salt used, so that it forms copper compounds. If sal ammoniac be employed, copper chloride is formed, by which the liquid near the copper is colored blue. This local action is called the charging of the battery. The nascent hydrogen liberated at the surface of the copper decomposes the copper compounds, which are, however, again formed by the action of the carbon; in other words, the element keeps charging itself continuously.

The element, having depolarizing materials which are easily decomposed, remains very constant in its action, and the results of a continuous test of the element closed through 10 ohms external resistance for a period of 670 hours gave the following mean values: E. M. F. = 0.932 volt.; current = 0.0846 ampère; internal resistance = 1.016 ohm.

By varying the proportions and increasing the size of the parts this cell can be used for heavier currents.

In the illustrations herewith, taken from the *Elektrotech. Ztsch.*, Fig. 2 represents a cell adapted for intermittent work. It differs from that shown in Fig. 1, in that the carbon is not coppered but is impregnated with easily oxidizable salts.

Gravity plays an important part in the action of the cell, which must therefore remain undisturbed. Since the upper layers of the liquid can never become saturated solutions, the crystallization and "creeping" of salts can not take place.

The Baltimore & Ohio System in the South.

The announcement has been made that the Baltimore & Ohio Telegraph Company proposes to extend its Southern lines so as to parallel certain lines of the Gould railroad telegraph systems. President D. H. Bates, of the Baltimore & Ohio Telegraph Company, said last week that he did not feel free to discuss any plans which his company might have in view for extending and developing its business. He did not put much faith in the value of a policy which led men to proclaim all their purposes. He did not deny, however, that the story, as current, was practically true.

In the new extensions of the Baltimore & Ohio system it is said that there will be a main line from Washington to Montgomery, Ala., and to New Orleans, making direct connections with other Southern cities. About 5,500 miles of wire are to be stretched, the pole mileage being about 1,700 miles. It is said that $700,000 has been raised to push the enterprise to success, while the cost is not expected to rise much, if any, above $600,000.

The Southern Telegraph Company is held by a traffic arrangement to the Western Union Company. President Bates and other gentlemen interested went to Richmond over a month ago to attend a sale at which it was advertised the company was to be closed out. The sale was postponed for some reason, though the Baltimore & Ohio were ready to buy at a certain figure.

Battery Practice.

To the Editor of The Electrical World:

SIR: Will you kindly answer the following questions: 1. If two batteries are placed to work in opposition to each other, will they be used up as rapidly as if placed in a regular circuit, supposing the batteries to have the same E. M. F.? 2. Could open-circuit batteries be placed on such a circuit indefinitely without being destroyed? 3. How many cells of ordinary gravity batteries would be required to operate fifty relays of 200 ohms resistance on a circuit of ten miles, ciruit to be of copper wire about No. 9? 4. Are automatic telephone exchanges used to any extent? If not, why? A CURIOUS CUSS.

PHILADELPHIA

ANSWER.—1. No. 2. Theoretically, yes; but practically the conditions of the battery would soon change and action begin, so that the arrangement is impracticable. 3. About 250 cells. 4. We do not know what you mean by "automatic telephone exchanges."—EDS. E. W.

Horse-Power and Volt-Amperes.

To the Editor of The Electrical World:

SIR: In answer to my inquiry, in your last issue you state "746 volts at the terminals of a resistance of one ohm gives 746 ampères, and hence 556,516 volt-ampères." Am I not to understand that to perform the above work it would require 746 horse-power instead of only one horse-power, as required to produce 27.3 ampères in one ohm?

J. C. MCC.

ANSWER.—Five hundred and fifty-six thousand five hundred and sixteen volt-ampères or watts are equal to 746 horse-power, and hence that is the power required to maintain a current of 746 ampères at a potential of 746 volts. You might read profitably Day's "Electric Light Arithmetic."—EDS. E. W.

Series, Shunt and Compound Dynamos.

To the Editor of The Electrical World:

SIR: To settle an argument, would you please let us know through your valuable journal if there is upon the market a series, shunt or compound wound dynamo for incandescent lamps that could have from one to eighty per cent. of its lights put out and the remaining lights remain at the same candle-power without the movement of the brushes, without interposing equal resistance, or without a corresponding decrease of speed, so that the dynamo would take care of its external circuit, be it increased or decreased in its number of lights? B.

AKRON, O.

ANSWER.—There are machines of all three descriptions on the market which would satisfy your conditions. In shunt or compound machines of good design no external regulation is needed; but in the series machine the field resistance would have to be altered in accordance with the number of lights. As this condition is not included among yours, we reply as above. Ordinarily, the shunt and compound machines alone are considered as *self-regulating* in the proper sense of that term, and would fulfill your conditions.—EDS. E. W.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, May 10, 1886.

The offices of Day's Kerite were removed last week from the Equitable Building to 16 Dey street, where Mr. Clark B. Hotchkiss has taken the second floor through. This important change serves to give Dey street more of an electrical appearance than ever, and the new quarters will, as soon as various little improvements are finished, be extremely commodious and cheerful.

Preparations are being made to place 143 new electric lights in some of the thoroughfares of the Eastern and Western districts of Brooklyn. Among the first to be lighted will be Court street, from Atlantic to Hamilton avenue. The 143 lights will displace about 860 gas lamps.

The Consolidated Stock and Petroleum Exchange has established a "ticker" service, by which its quotations are carried to the offices of its members, to the hotels and other places. The first circuit of instruments was started on May 3.

Mr. Henry E. Stammers, of 1430 Broadway, this city, gets out a very neat catalogue of his electro-medical batteries and electrodes. Many of his specialties have been made from designs furnished by eminent practitioners, and he is at all times ready to make any design to order. The goods themselves look well, and have a high reputation for serviceability.

I find the following editorial item in the *Spectator*, insurance weekly review: "It is probable that the heavy loss by the August, Bernheim & Bauer fire at Nos. 512-516 Broadway, on Thursday, would have been averted had the alarm been sent out promptly. It appears that the headway gained by the flames was occasioned by a want of faith on the part of the operators of the automatic fire alarm in the working of their own system. In the incipient stage of the fire the heat affected the sensitive thermostats, and an electric alarm was at once transmitted to headquarters, but the man in charge having had recent experience in grounded wires, instead of promptly sending out an alarm of fire sent a messenger, it is reported, to ascertain what the trouble was at 516 Broadway. When the messenger arrived at the building he found it in flames, and policemen had in the meantime discovered the fire and given the alarm. Many minutes, according to this report, were lost in notifying the fire department, and the fire was allowed to make great headway. The incident does not signify the inefficacy of the automatic fire alarm, but rather inefficiency and carelessness on the part of the man in charge of the system at the time of the fire. The result was a loss of over $500,000 to the insurance companies—a very substantial slice taken from the premium receipts on New York city business."

Mr. G. H. Benjamin, 146 Broadway, has moved to 35 Wall street, New York.

F. C. Linde & Co., St. John's Park, this city, have taken 22 telethermometers for refrigerators, from the Telemeter Company. The United States Treasury has taken two telehydrobarometers. It is rumored that one party has contracted to take 300 telethermometers per annum for five years, the instruments to be placed in one trade in New York and the vicinity.

The trustees of the Brooklyn Bridge receive $30 a year for all wires stretched across the bridge except those belonging to public departments. The last rent-roll of wires was as follows:

	Number of wires.	Amount per annum.
Metropolitan Tel. & Tel. Co.	196	$5,880
Baltimore & Ohio Tel. Co.	33	990
Western Union Tel. Co.	20	600
Law Tel. Co.	14	420
Mutual Union Tel. Co.	10	300
Gold & Stock Tel. Co.	7	210
F. Friedman	2	60
S. H. Peters	1	30
Richardson, Boynton & Co.	1	30
Erie Preserving Co.	1	30
Miles Brothers & Co.	1	30
Union White Lead Manufacturing Co.	1	30
F. O. Pierce & Co.	1	30
P. White's Sons	1	30
George H. Prentice & Co.	1	30
Telegraph Time Co.	1	30
Commercial Cable Co.	1 cable	250
Totals	292	$8,980

I am told that there is a tendency toward cabling the Bridge wires. Mr. Hotchkiss has just filled an order for two Kerite cables to go across the Bridge next Sunday—one of 3,262 feet, 15-conductor, and one of 500 feet, 20-conductor—for the Western Union.

Col. W. P. Shinn, president of the Electric Time Company, 146 Broadway, has arrived at San Francisco, on board a special hotel car, in the company of President Andrews of the Pittsburgh, Cleveland & Toledo Railroad, and a large party of ladies and gentleman. It is wholly a pleasure trip, to see the Californian flowers that bloom in the Spring. The party leaves May 10 for the Yellowstone and National Park, and Mr. Shinn stops on the return trip at Salt Lake City to attend the meeting of the Society of Civil Engineers.

Mr. H. N. Curtis, the New York agent for the Thomson-Houston Company, is placing an isolated plant in the large dry goods store of Mr. Henry Batterman, corner of Graham avenue and Broadway, Brooklyn, E. D. The plant consists of a dynamo driven by a balanced engine from B. C. Waite, of Brooklyn, and 38 arc lamps are used, lighting up all parts of the building.

The Excelsior Electric Company, of 9 Dey street, has introduced its new incandescent dynamo, illustrated in THE ELECTRICAL WORLD, a short time ago, into the dry goods store of Wechsler & Abrahams, 424 to 432 Fulton street, Brooklyn. It is running 250 incandescent lamps of 16 candle-power.

Mr. C. H. Dubois, with an experience of over 35 years, announces that he has, with W. A. Dubois, formed a copartnership under the firm name of C. H. Dubois & Son, at 61 Ann street, for the manufacture and repair of telegraph instruments, electric light machinery, fire alarm, burglar alarm and electrical apparatus of every description. Mr. C. H. Dubois was for five years with John W. Norton, the first house to manufacture this line of goods to any extent in this country, subsequently for 25 years in charge of the well-known shop of the Messrs. C. T. & J. N. Chester, at 104 Centre street, and for the past six years occupied the same position with J. H. Longstreet.

Mr. Candee reports the Okonite Company to be doing a brisk business, with orders now in hand that will run the factory into June. The Western Union Company has taken 11 miles of 19-conductor cable for New York City lines and has ordered other quantities for various points throughout the country. The company has also recently filed orders for 70 miles of various Okonite cables for shipment abroad.

Some years ago Mr. Henry W. Pope, who was familiar with the workings of an analogous club at Providence, suggested that it would be a good thing to have an electric social club and exchange in New York. He advocated the idea warmly, but he was not supported as he should have been. The idea is now revived, and at a meeting of a few gentlemen held at the Union Square Hotel on the 8th inst, the following officers were elected provisionally: President, Henry C. Davis; Vice-Presidents, George W. Hebard, John B. Powell, O. E. Madden and George L. Beetle; Recording Secretary, Eugene T. Lynch, Jr.; Corresponding Secretary, Charles W. Price; Treasurer, Andrew J. Dam; Custodian, H. B. Thayer; Members of Executive Committee, Eugene F. Phillips, Hugh R. Garden, Henry C. Adams, Thomas L. Fowler, Henry D. Stanley, William L. Candee, Clark B. Hotchkiss, H. L. Storke, Charles Dutton, C. H. Barney, M. W. Goodyear, Ralph W. Pope and John W. Beane. Several of these gentlemen were not present, and it is not yet known whether they approve the objects of the Club or will serve. There really is need for a good social meeting place downtown for electrical men.

A notable new departure in the electric lighting field is the establishment of the Ball Electric Light Company at 160, 162 and 164 Broadway, with a capital stock of $500,000. The officers are DeWitt C. Wheeler, the well-known ex-Police Commissioner, as President; C. P. Whitney, late Secretary of the Brush-Swan and Swan incandescent companies, as Secretary and Treasurer; Royal E. Ball as Electrician, and Charles E. Ball as Mechanical Manager. The factory will be located in East Ninth street. The company undertakes to supply both kinds of light and to do incandescent lighting on long arc circuits, figuring one arc light and two 16 c. p. incandescent for two-thirds of a horse-power. The company is pushing operations with the utmost activity.

Now that so many telegraph men and other electricals are interested in the typewriter, it may be well to record that an ingenious application of the cyclostyle to typewriting has been made by the Cyclostyle Company of 12 Cortlandt street. A sheet of patented sensitive paper is laid on a sheet of prepared, roughened perforating paper, and the two together put into the carriage of the typewriter. The type in striking on the sensitive paper forces the same against the rough surface at the back of sensitive sheet, thus breaking the surface of same, and making a stencil composed of minute dots so close together as to appear a continuous line. The sensitive sheet is then fixed in the cyclostyle printing frame, and an inked roller passed over same. This forces the ink through the perforations on to a sheet of paper previously placed under same, and a perfect copy is obtained. A signature or alteration may be made with the cyclostyle pen and duplicated at same time. This gives a circular every appearance of an original type-written letter with autograph signature. Several hundred copies can be made this way.

Westinghouse, Church, Kerr & Co., in enlarging their office quarters at 15 Cortlandt street, have seized the opportunity to put in a compact little plant which comprises a 300-light dynamo and a Westinghouse engine. So little space does the plant occupy in the basement that, unless informed of its location, one would have some trouble in finding it. Wiring is now going on, and at the start probably about 250 lights will be run, including some of the 150 c. p. Several of the lights will be placed in the adjoining restaurant and the main hallway. Steam for the engine is taken from the street pipes. I am told that the Westinghouse plant at the Windsor Hotel on Fifth avenue is doing superlatively well. One novel feature is that the dynamos are put on the same circuit—in multiple arc—no matter what may be their difference in load. This, if I am not mistaken, is a decided innovation, and quite impossible according to some authorities, the practice being to run the dynamos independently until their loads are equal.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Mass., May 10, 1886.

The electric watchman's clock, manufactured by the Tarbox Time Register Company, of this city, is finding a very large sale among factories and large business establishments.

The large central station recently started in this city by the Edison Electric & Illuminating Company has just had its capacity increased by the addition of two more 300-light (16 c. p.) incandescent dynamos.

The valuation of the property of the Western Union Telegraph Company in New Hampshire has been reduced from $175,000 to $150,000 by the State Board of Equalization.

The New England Pottery Company in South Boston is supplying quite a number of electrical concerns with a fine grade of porous cups of all desired shapes and sizes to order.

The Jarvis Engineering Company has shipped to the Owen Sound Electric Light Company, Owen Sound, Ontario, a six-foot tubular boiler set with the Jarvis patent furnace. The Edison Electric Light Company, of Lebanon, Pa., has completed the setting of its tubular boiler with this furnace.

The Hall Rubber Company, offices Nos. 52 and 54 Summer street, this city (factory, Watertown, Mass.), is catering to the electrical supply dealers of the country. This company makes a fine grade of friction cloth which has been found indispensable for certain electrical purposes. The company does a very large business in sheet rubber and rubber tubing.

On the 7th instant the Massachusetts House of Representatives voted 146 to 61 in favor of the bill restricting telephone charges. The bill provides that not more than $4 shall be charged per month for each set of instruments, or more than $3 when two or more sets of telephones are rented by one party; also that when two cities or towns are connected by wires operated by any individual, company or corporation, the price for use of telephone shall not exceed fifteen cents for the first five minutes, and for each additional five minutes not more than five cents. There is a penalty of $25 affixed to the bill. It is expected that the Senate will take action upon the bill at an early day this week, and it is predicted that the course pursued by the House will be concurred in.

The Holyoke Water Power Company, at Holyoke, Mass., has successfully supplied the electric light station in that city for so long a time and at so low a cost, that considerable interest has been awakened among the electric lighting companies in that section. It is said that arrangements are now being perfected to furnish power in same manner for lighting Springfield and Northampton, and that wires will be run to both places as soon as practicable.

The Thomson-Houston Electric Company continues to push its system with the same activity that characterized its course during the year 1885. Since the beginning of the month of April said company has furnished the following lights: 30 arc lights, Brush-Swan Electric Light Company (new plant), Winooski, Vt.; 135 arc lights, Troy Electric Light Company (new plant), Troy, N. Y.; 30 arc lights, C. G. Hudnutt (new plant), Big Rapids, Mich.; 75 arc lights, Wilmington Electric Light Company (new plant), Wilmington, N. C.; 30 arc lights, Yonkers Electric Light Company (increase), Yonkers, N.Y.; 30 arc lights, Lafayette Electric Light Company (increase), Lafayette, Ind.; 30 arc lights, Galesburg Electric Light Company (increase), Galesburg, Ill.; 45 arc lights, Omaha Electric Light Company (increase), Omaha, Neb.; 300 incandescent lights, Middlesex Electric Light Company (new plant), Lowell, Mass.; 150 incandescent lights (new plant), for the new Grand Army building at Lynn, Mass., and work is being pushed forward on a new arc and incandescent plant in Waterville, Me.

The Boston Board of Aldermen gave a hearing on the 6th instant to the Edison Illuminating Company of this city, in regard to their applications to put in underground wires in the city of Boston. All the telephone and electric light people were present, but no objections were made to burying wires for incandescent lamps. The underwriters objected to placing arc wires of 2500 volts underground, but did not oppose low tension wires. The General Superintendent of the Edison Company, Mr. J. H. Vail, explained their system of carrying the wires through iron pipes. He said they had in the United States and Europe 54 miles of underground wires in use, they had 260,000 lamps running from isolated plants, and 90,000 from central stations. There is no question but what the application will be granted. They ask for permission to place the wires from Indiana place on Washington street to Court street.

The Eastern Electric Cable Company of this city has recently made several large sales of its electric light cable to leading electric lighting companies of this section, and so far as could be ascertained, the cable has given thorough satisfaction. The manufacturers of the cable are prepared to meet the requirements of those desiring a reliable, durable and economical cable, either aërial, underground or submarine, and say that they will guarantee the insulation in all. It is said that there is no case on record where the cables or wires made by the Eastern Electric Cable Company have been either short-circuited or burned out. The company has the highest testimonials from influential sources relative to the merits of the cable referred to.

The Citizens' Electric Light Company, of East Boston, is running a number of the Bernstein incandescent lamps of high candle-power on its arc light circuit, and is creating much gratification among the customers who have been already supplied, and a large demand has arisen for more. The company is operating, among its other dynamos, an American (Wood) 50-light machine, which more than fills the expectations of the officers of the company, and is giving the utmost satisfaction to the people of East Boston.

Mr. Joseph S. Fay has been elected president, and C. Howard Moulton treasurer, of the Electric Gas Lighting Company, of this city, to succeed H. S. Russell and J. H. Howard, respectively.

Mr. James A. Derrom, manager of the Venezuela (S. A.) business for the Inter-continental Telephone Company, has been in Boston for several days. He expects to return to South America about the last week in May, taking with him a multiple switch-board for the Caracas exchange. Mr. Derrom reports the outlook in general as very fair in his section of the country, and that telephone customers are constantly increasing in number.

W. I. B.

HARTFORD, Conn., May 8, 1886.

The Mather Electric Co. is very busy filling orders, and in its factory, on Sheldon street, everything fairly hums with the activity and bustle going on. The company has just fitted up the following isolated plants, Haverhill (Mass.) Paper Co., 300 incandescent lights; Sebago Mills, Windham, Me., 100 incandescent lights, and the *Gazette* Publishing Co.'s fine building, Cincinnati, with 300 incandescent lights.

Mr. John Tregoning, formerly foreman in the factory of the Schuyler Electric Light Company, recently accepted the position of assistant superintendent with the Mather Company, and will assume the management of the factory building.

Mr. D. E. Smith, of this city, has been for years identified with numerous electrical enterprises, and his name is familiar to a large number of the electrical fraternity. He has now become permanently engaged in the patent business.

The Hartford Rubber Works make a large line of novelties, tubing without seam, and a full line of rubber goods for electrical and mechanical purposes.

The Schuyler Electric Light Company finds it necessary to take advantage of all of its enormous manufacturing facilities to keep pace with the orders pouring in. It recently filled a contract for the Stamford Electric Light Company for 100 arc lights and 150 incandescent lights, and has just equipped arc light stations at Kingston, N.Y., and Wichita, Kan., for 90 and 100 lights respectively. The new stations of the company at Westfield, Mass., and Attleboro', Mass., are giving thorough satisfaction, and an increase in both is daily looked for.

The Waterhouse Electric and Manufacturing Company has its system ready for competition with those of older electric lighting enterprises. The dynamo and lamps which were shown in THE ELECTRICAL WORLD of May 1 are attractive in appearance, and are the results of electrical and mechanical skill. The lamps deserve special mention from the fact that the automatic regulator attached to both No. 1 and No. 2 overcomes any jarring or shaking, and keeps the carbons constantly at a long arc—thus giving a steady light permanently. The inventor, Mr. A. G. Waterhouse, deserves great credit for his skill in producing an automatic regulator for his lamp, which is possessed of such genuine merit that electricians who have seen it pronounce it both useful and indispensable; and the Patent Office at Washington granted without hesitation what is termed a "broad patent" upon it.

The entire apparatus made by the Waterhouse Electric and Manufacturing Co. is well worthy the attention of those interested in the advancement of electric lighting, and it is safe to predict that this new system will soon find its way to the front rank. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, May 10, 1886.

The electric light is spreading very quickly in Philadelphia, special efforts being made to have the lights placed particularly in those districts famous for the unlawful character of the residents and frequenters, for crime does not love light. Since Jan. 1 fifteen lights have been placed on Second street, between Mifflin and Brown, while Bainbridge, from Fourth to Twenty-second, has received nine. On South street, lamps have been placed at the intersections of Seventh street, Fifteenth and Sixteenth streets, and on Eleventh street, from Fitzwater to Carpenter street, there are four. Five have gone up on Twenty-second, between Chestnut and South; three on Federal, from Broad to Seventeenth; the same number on Willow, from Fourth to Sixth; on Eighth, from Chestnut to Green, and on Vine, from Eighth to Tenth. Down on Beach street, above Poplar, a rather unpleasant neighborhood at night, three have been placed, and on Canal street, from Front to Laurel, another unsavory locality, there are two. West Philadelphia has received six lights; two on Lancaster avenue, at Thirty-sixth and Powelton avenue; two on Thirty-eighth, at Hamilton and Spring Garden, and two on Thirty-second, at Chestnut and Walnut. On Market, from the Delaware to the Schuylkill, five additional lights have been placed, making the total fifteen. Chestnut has received none this year, but has fifty-five between the Delaware and Thirty-third street. Six have been put up on Fairmount avenue, from Broad to Twentieth, and Columbia avenue has received four additional lights, making sixteen between Ninth and Twenty-first. Nine new ones light Girard avenue, from Palmer to Thirteenth, and Spring Garden, from Sixth to Broad, has ten; Ridge avenue, from Callowhill to Master, six, and Germantown avenue, from Columbia avenue to Susquehanna, five The three put up on Frankford avenue, between York and Lehigh avenue, burn only until midnight. An additional light has been placed on Poplar street, making eighteen from Delaware avenue to Seventh, and two more on Broad, bringing the number there up to twenty-eight. In Germantown in the suburbs there are now fourteen lights, seven having been placed this year, and Frankford has ten, which, however, only burn until midnight. As soon as the underground wires are laid on Broad street, from Columbia avenue to the Reading Railroad, eight lights will be placed there. The city now pays for 344 electric lights at the rate of fifty-four cents each per night, and when the eight on North Broad street are put up the number will be increased to 352. Six companies do the lighting, the Brush having 155 lamps; the United States, 135; the Northern, 16; the Philadelphia, 14; the Germantown, 14, and the Frankford Company, 10. The contracts between the city and the companies require that each lamp shall burn for eight hours, and when a light goes out sooner the company is compelled to make a proportionate reduction in its bill.

The use of the light is also growing very fast at Atlantic City, the favorite seaside resort of most Philadelphians. It is now a settled fact that the Edison incandescent electric light will soon add its lustre to the other attractions of that city by the sea. The new electric light company of Atlantic City have contracted with the Edison Electric Light Company to do the work, and material for the same is now there and on the way, and the work will be pushed vigorously to completion. The stock is limited, and there are no bonds. The people seem to be a unit in demanding a fair competition in lighting that will be likely to give them a better light at lower figures. The majority of Council is with the people for this change.

The electric light is spreading very quickly in the country towns hereabouts. During last week charters were issued to the United States Light and Fuel Company of Philadelphia, with a capital of $250.000, and the People's Electric Light Company, of York, Pa., with a capital of $25,000. Over in Jersey, Haddonfield, near Camden, is to have a new water and electric light works, and a number of capitalists have applied to the Secretary of State of New Jersey for permission to take out a charter. The Borough Commissioners have granted the privilege of laying pipes and stretching wires along the streets. The amount of capital thought necessary is $40,000, all of which has been subscribed.

Mr. W. T. Brown is booming the Roberts permanganate battery in this city. It seems to fulfill the demands. Over five hundred were disposed of within the past week.

So far from any more talk of burying the wires, another company—the People's Telephone—is before City Councils, asking for permission to erect aërial lines throughout the city for a short-line service. During this week, a committee of Councils has acted affirmatively on an ordinance granting permission to the Philadelphia Electric Lighting Company to erect poles and stretch wires on Pennsylvania avenue, from Twenty-third to Thirtieth streets. The object of the grant is to furnish the power to maintain electric lights, which are to be located in different parts of Fairmount Park. Ordinance was acted on affirmatively.

On the other hand, some of the citizens seem disposed to take the matter into their own hands, and one property owner publishes a notice to all telephone and telegraph companies saying that all wires at Filbert and Juniper streets, and at Tenth and Arch streets must be removed by the 15th inst. "or they will be cut."

Messrs. Clay & Bratton are still pushing their plan of establishing a public pneumatic dispatch service throughout the city. They exhibit a working model of the scheme, which contemplates brass conduits two and a half inches in diameter, for transmitting messages and small packages between business places at a reasonable cost. Permission has already been granted Bratton & Clay to lay these tubes by Councils, but during the consideration of the plan the firm has been changed to a stock company called the Electrical Pneumatic Transit Company. Another ordinance will, therefore, be introduced requesting the withdrawal of that permission and granting it to the new company.

The Baltimore & Ohio, considering that its privileges in this State were cramped, has taken out a charter for the "Baltimore & Ohio Telegraph Company of Pennsylvania." The capital is set down at $200,000, and the principal office will be in Philadelphia. The directors are Frank W. Griffin, Joseph R. Kenney and J. S. W. Phillips, of Philadelphia; D. H. Bates, of New York, and Charles Selden, of Philadelphia. This company is making experiments with and promises great results from the "phonoplex," which THE ELECTRICAL WORLD lately described and illustrated.

A picked nine of operators from the Western Union and Baltimore & Ohio in Wilmington, Del., played a desperate game of base-ball with a nine from a local newspaper last week. The Knights of the Key were badly beaten by a score of 25 to 16, besides suffering from the bombardment of the scribes. Their catcher, Harry Murdock, a well-known telegrapher, was taken from the field with a broken nose.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, May 8, 1886.

The western office of THE ELECTRICAL WORLD has been removed to 44 Lakeside Building.

On Monday night, 28th ult., the Western Union Telegraph Company, Indianapolis, suffered considerably by fire, all connections with the switch-boards burning off. The wires were carried from the office poles into the battery room and direct to lightning arresters in cables; from arresters down through to switch-board by another lot of cables, all of which were burned out, cutting off all connection. The fire occurred about 8 o'clock in the evening, and by 9:30 they had nine wires in working order again, giving them connection with Cincinnati, Chicago, Louisville, Evansville, St. Louis, Pittsburgh and New York. By daylight Tuesday morning there were 45 wires connected to the switch-boards, which fortunately were not damaged. By 2:30 P. M. Tuesday all wires, 92 in number, were connected and in working order. About 300 cells of battery were disabled by the intense heat. W. A. K.

CANADIAN NOTES.

TORONTO, Can., May 3, 1886.

Mr. J. J. Wright, the electrician of the Toronto Electric Light Company, has been appointed General Manager of that company, in place of Mr. S. Hamburger, retired.

The Toronto Electric Light Company has one of the most complete electric lighting plants in the country. It purchases no plant, but builds its own dynamos and lamps, and does all its own repairing on the premises. It is now adding 16 x 24 braiders of the New England Butt Company to the shop plant to insulate all the circuit wire used. By working on this plan it has placed its concern in the front rank of dividend-paying companies. It has closed a contract to equip the Industrial Exhibition electrical railway with power to drive four cars besides the motor car. The track is about a mile long, and last year the road carried 50,000 passengers during the ten days of the exhibition. The motor car will be equipped in the most complete manner, with friction gearing and powerful electric brakes. The curves on the road are being straightened, and it is expected to be able to make a double trip in five minutes including stoppages. The contract calls for the completion of the road by the 15th of August next.

THE TELEGRAPH.

T. M. B A.—Assessment No. 197 of $1, for May, covers the death claims of Carl A. Mathiesen, Dennis Hurley and Thomas L. Crouch. There are now 2,984 members in good standing in the First Division and 359 in the Second.

A New Atlantic Cable.—A dispatch from Paris, dated the 6th inst., says: M. Granet, Minister of Posts and Telegraphs, has granted a charter to a French Company to lay a cable between Brest and New York *via* Guadeloupe. The State guarantees a portion of the capital on condition that the cable be manufactured in France and be laid by French vessels. The charter requires the sanction of the French Parliament.

Reporting Base-ball by Telegraph.—The base-ball craze has reached its highest point of development in the South. When the Atlanta Club is playing in other cities the Atlanta people, men and women, rush to the Opera House at the hour set for the game, where there is an actual diamond on the stage, around which are stationed boys in uniform, to represent the real players. They run the bases by telegraph, as it is being done in the game at the other end of the wire.

No Compromise.—It was rumored this week that the Commercial Cable Company had opened negotiations with Jay Gould for a settlement of the cable rate war. Manager Ward, of the Commercial Company, emphatically denied the truth of the report, as he did also another report that the pooled lines had begun the war of rates for the purpose of preventing the Commercial Company from placing on the London market a $3,000.000 loan. Mr. Ward said that this loan had been quietly placed among friends of John A. Mackay three months ago. He reports that his company is doing a big business at the 25 cent. rate.

Fighting for Delay.—An order was applied for in the Supreme Court, Chambers, this city, on May 10, by A. J. Vanderpoel and A. Goodwin, counsel for the Western Union Telegraph Company, directing Gen. John G. Farnsworth to furnish a bill of particulars in his suit, as receiver of the Bankers and Merchants' Telegraph Company, against the Western Union. Ex-Senator Conkling, who, with Edward Lauterbach, represented the plaintiff, opposed the motion as only another measure to delay the trial, which is set down for next Monday. Justice Daniels has denied the motion.

Signal Service Reorganization.—As a member of the Congressional Commission which has been investigating the various scientific bureaus of of the Government, Senator Morgan has learned enough, it appears, to convince him that the Signal Service Bureau as now conducted ought to be entirely reorganized. Mr. Morgan has put his ideas into the form of a bill, which he introduced last week. Mr. Morgan's bill provides for the abolishment of the Signal Service Bureau on the 1st of July and the establishment of a Weather Bureau in the War Department under the direction of the Secretary of War. General Hazen and other commissioned officers now in the Signal Service Corps may be temporarily assigned to duty in the new bureau, but it is to be organized as a civil establishment. The Chief Director and three Professors of Meteorology, one of whom is to be Assistant Director, are to be appointed by the President, subject to confirmation by the Senate. Enlisted men and non-commissioned officers now in the service are to be discharged, but are to have the preference in appointments to places in the civil bureau. Various minor features are provided for by Mr. Morgan, who believes his bill will become a law.

THE TELEPHONE.

A Good Increase.—There was a net gain of 135 subscribers in New York City last month. Evidently the rates exacted are no great detriment.

Indianapolis.—A great many of the business men approve of the proposed charge-per-switch system, as a means of escape from the present deadlock.

Suing the Inter-State.—The Bell Company filed a bill at Chicago, on May 10, in the United States Circuit Court, against the Inter-State Telephone Company, to restrain it from using the Bell patents. The Inter-State Company is operating under patents issued to George M. Hopkins. Its chief stockholder is Charles Whitlock, who was once one of the originators of the People's Telephone and Telegraph Company, and as such was enjoined from infringing the Bell patents.

Telephone Decision.—On Thursday last Vice-Chancellor Bird, of the State of New Jersey, filed at Trenton his decision in the case of the Domestic Telegraph and Telephone Company against the Metropolitan Telephone and Telegraph Company, and the New York and New Jersey Telegraph Company. The decision is in favor of the Domestic Company and in accordance with the prayer of the bill, which continues their license for five years, secures them telephones, and allows them full costs.

Western Australia.—Our advices from Perth state that the Colonial government is taking steps to introduce the telephone, by establishing exchanges at Perth and Freemantle. It has secured the services of Mr. William J. Hancock, A. S. T. E., of Dublin, as Superintendent of Telephones, and that gentleman arrived in Perth early this year to commence his duties. Mr. Hancock has had considerable experience in the working of telephones in connection with the Dublin Exchange, which has about 900 subscribers, who use it to the extent of about 7,000 messages per diem.

Judge Thurman's Tonic.—Reports from Columbus, O., announce that ex-Senator Thurman, who is counsel for the Government in the suit against the Bell Company, is busy "forging the Jovian thunderbolts that are to knock down the ramparts of the Bell monopoly." We are told also that "the Bell Telephone suit has been a wonderful tonic for Judge Thurman. It reminds one of the classic character whose strength was renewed and made perpetual by laying burdens upon his shoulders. This new public burden laid upon Judge Thurman has extirpated the neuralgia with which he has been troubled for a few years, and turned back the hands of the clock for a decade. From this time on until the final hearing Judge Thurman will be busy in the case and in consultation with his co-counsel, the most of whom will be here off and on during the summer."

THE ELECTRIC LIGHT.

Naiads at a Circus.—An ingenious idea has been carried out at the new circus in Paris, where the Sisters Johnson are nightly astonishing the natives with their aquatic feats. The swimming bath is lit up by electricity from below, so that the theatre being darkened, the water becomes a transparency in which the movements of the naiads can be minutely followed.

Engineers Visiting a Station.—At the recent meeting of the Southern Society of Civil Engineers, at Jacksonville, Fla., one session was held at the American-Edison station, on invitation of the manager and proprietor, Dr. J. A. Cloud, who is a member. The Doctor gave his guests a good description of the plant they saw in operation, and sent them away highly pleased.

N. E. L. A.—The Executive Committee of the National Electric Light Association met on the 11th and 12th inst. at the Hotel Dam, this city, and completed arrangements for holding the annual meeting of the association in Detroit, beginning on Aug. 31. The committee considered the project of establishing a bureau of information to collect facts bearing upon the electric light, and will bring the matter up for action at the Detroit meeting. Among those present were Secretary McCoubray and Messrs. Frank Ridlon, Eugene T. Lynch, Jr., Dr. Otto Moses, J. F. Morrison, C. Cooper, A. J. De Camp and Charles Stewart. The next meeting of the Committee will be held in this city on June 29.

APPLICATIONS OF POWER.

The Sprague Motor.—A very satisfactory run was made last week with this motor on the Thirty-fourth street branch of the Third Avenue Elevated Railway. The Duke of Sutherland was among those present.

PERSONALS.

Mr. George C. Pyle, the electrician for the American Electric Headlight Company, is the inventor of the headlight now being used on all the night trains of the Mt. Vernon and Pan Handle route. The light appears to be highly spoken of by all the railroad men who have seen or used it.

Mr. J. A. Seely, of the Metropolitan Telephone Company, is of opinion that the charge-per-switch system as used in San Francisco and described in the WORLD last week, would not work in the city of New York with its 6,000 subscribers, and he instances the case of Washington, where as soon as the subscribers increased, that system was abandoned as involving too much detail and worry.

Mr. J. P. Tavis, whose prominent connection with New York telephone interests has given him unusual experience in regard to the difficulties that pertain to the operation of telephone lines, whether overhead or underground, returned this week from Europe, where, it is understood, he has made a special study and investigation of underground methods in vogue, with relation to the problem as it presents itself for solution in New York.

Mr. Edison and His Bride.—A dispatch from Akron O., says: Mr. and Mrs Thomas A. Edison are in the cit

spending a week with Mrs. Edison's parents, Mr. and Mrs. Lewis Miller. The electrician and his wife will, at the end of the week, go to their home in Llewellyn Park, New Jersey, where they will spend the summer, when they will again return to Florida, from which place they have just come.

Mr. Paul Seiler, whose new annunciator system was illustrated and described in these pages last week, is the superintendent and electrician of the California Electrical Works, San Francisco. He is a man of no small ingenuity, as the device in question shows, and his work covers the whole field of the large business done by the Works. His electro-medical apparatus is said to be highly valued on the Coast. Some eight or ten sets of the apparatus are now in use in Oakland and San Francisco alone.

Mr. Charles F. Brush, the distinguished inventor and electrician, has, according to trustworthy report, just completed for his own occupation the finest mansion that Cleveland, a city of superb homes, can boast. It is said to be somewhat smaller, as a whole, than other well-known Cleveland houses, but to have the largest room to be found in any private dwelling in the city, and to be beyond compare in the style and richness of its decorations.

Mr. James D. Reid has already disposed of 250 copies of the edition de luxe of his admirable work "The Telegraph in America," just republished, and is now busy filling orders for another 250, which will be similarly bound in Russia, and will, if desired, bear the gold-stamped name of the purchaser. A copy of this book should be owned by every one interested in electrical history. Its main theme is the telegraph, but it necessarily embraces a great many other subjects of the most vital interest to electricians.

Col. G. L. Beetle, of the American Electrical Works, has sustained a severe personal loss in the death of his promising young son, George Beetle, Jr., who shot himself accidentally at Paterson, N. J., on April 29, and died a few days later. The young man had already evinced great talent in electrical science and invention, and had recently started in business. The news of his sudden death so affected his brother-in-law, Mr. R. J. Bowes, that the latter on hearing it died suddenly of heart-disease. The remains of both are now at Woodlawn Cemetery, N. Y. The interment and services will take place on the 16th inst. Col. Beetle has in this double affliction the deepest sympathy of a very wide circle of friends.

Mr. J. C. Henderson, the General Manager of the Electric Development Company, San Francisco, was the installing engineer on the Pacific Coast steamship "Columbia," the first vessel lit by electricity, and he went out to San Francisco in charge of the plant. Since then he has continued to take an active interest in electric lighting. He is now associated with Mr. Ladd, who is the agent for the Edison light in California, and the aim of the new company is to introduce the system in some of the smaller cities and towns, by means of local organizations.

Mr. A. F. Upton, the well-known general manager of the Jarvis Engineering Company, of Boston, holds advanced views on the subject of the transmission of power by electricity, and his remarkable figures and arguments addressed last February to the National Electric Light Association have attracted very general attention. It is said to be largely due to his vigorous presentation of the case, that the Edison Illuminating Company of New Bedford, Mass.; the Milford, Mass., Electric Light and Power Company; the Taunton, Mass., Electric Light Company; and the Edison Illuminating Company, Boston, have decided to devote part of their plant to power supply. Mr. Upton's idea is that "power is money."

Mr. Charles R. Truex, special agent of the American Bell Telephone Company for Pennsylvania, New Jersey, Delaware, West Virginia and Eastern Ohio, has severed his connection with that company and associated himself with the Electrical Accumulator Company of this city. Mr. Truex was with the Bell Company from 1879, and was, in fact, its first special agent. Very few men are as widely known or as popular in the telephone business as Mr. Truex, who leaves it with regret, and with the highest reputation; but he has found inducements to the change in the hope of developing a new electrical field commercially, and in the fact that he rejoins those with whom he has already done some of his most arduous and successful work.

MISCELLANEOUS NOTES.

Fouling an Ocean Cable.—The schooner Ethel, Capt. Merchant, arrived at Gloucester on April 26. She reports that while on the Banks, April 3 and 4, in longitude 65° 12″, latitude 42° 33″, she fouled with the old French cable. It was two days before the schooner could be cleared away from the cable, and then the anchor had to be cut away, losing it and about sixty fathoms of cable.

Hours of Labor.—S. Bergmann & Co., the manufacturers of electrical apparatus, have notified their employés that on and after Friday, May 7, nine hours instead of ten will constitute a day's work, and 53 hours instead of 59 a full week's work. During May, June, July and August the works will close at 12:30 P. M. on Saturdays. J. H. Bunnell & Co., the Western Electric Company and Pearce & Jones have taken similar action, it is said.

Vapor from Secondary Batteries.—Mr. F. Higgins, in the *Transactions* of the Society of Telegraph Engineers, suggests the use of a loose cover, such as the thinnest calico, to arrest the minute globules of acid projected into the air from secondary batteries. By this means the work in the vicinity of accumulators which are being charged is much less unpleasant and the corrosion of metal work prevented.

Expansion Produced by Amalgamation.—Profs. Ayrton and Perry have accidentally observed that the amalgamation of brass is accompanied by great expansive force. If one edge of a straight, thick brass bar be amalgamated it will be found that in a short time the bar is curved, the amalgamated edge being always convex and the opposite concave. The authors imagine that a similar action may be the primary cause of the phenomena presented by the Japanese "magic mirrors."

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—B. & M., b 2, a 3; Western Union, b 62, a 62¼.

Telephone.—Am. Bell, b 159, a 160; Erie, b 27½, a 27¾; New England, b 32½, a 32¾.

Electric Light.—No new quotations.

BUSINESS NOTICES.

L. W. Wolfe & Co., 206 North Sixteenth street, Omaha, Neb., issue a remarkably complete catalogue of electrical supplies. The firm claim to have the largest supply house west of Chicago, and to give New York prices. They certainly have neglected no branch of the business, and the figures they quote are very low. The catalogue contains nearly forty pages and embraces much valuable information. A specialty is made of electric light wires and carbons.

German Corn Remover

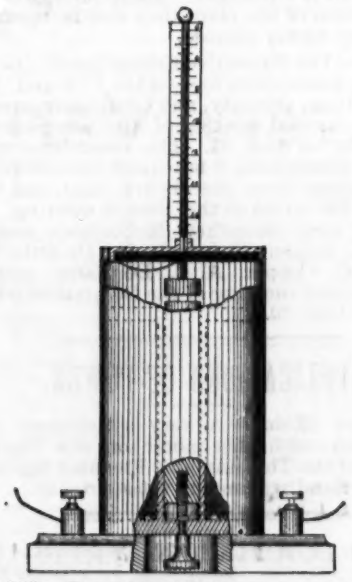
Kills corns and bunions, unfailing, rapid, painless; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure; 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals and beautifies the skin; 25c.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED APRIL 27, 1886.

340,537. Dynamo Commutator; Thomas E. Adams, Cleveland, O. Consists of the combination with the metal plates of a commutator of insulating removable cut-out segments of hard gummy woods.

(1) **340,538. Current Indicator**; (2) **340,539. Brush Shifter**; Edward H. Amet, Chicago, Ill., Assignor to himself and H. A. Streeter, same place. (1) As shown in the cut, it consists of an electro-magnet, the coil of which is connected with the circuit the current in which is to be measured, in combination with a collapsible closed vessel of large area provided with an indicating tube of small diameter, and the movable armature of the magnet, which operates to compress or bulge out the vessel and force the liquid therein to a greater or less



340,538. ELECTRIC CURRENT INDICATOR.

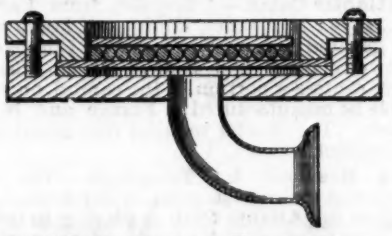
height, according to the strength of the magnet and the amount of current flowing through it. A graduated scale attached to the indicating tube will show the strength of the current in ampères or volts, or fractions thereof. (2) The position of the collecting brushes of the generator is automatically regulated or adjusted by means of a controlling magnet included in the circuit to be regulated, which operates as a relay to open and close circuits in which two electro-magnets are included.

340,618. Fire Alarm Apparatus; Charles D. Rogers, Providence, R. I. He covers the push button with a paper seal which must be broken or torn to give alarm.

340,684, 340,685. Electric Railway; Frank J. Sprague, New York, N. Y. (1) Consists of a braking-generator operated by the movement of the car, having its main field-magnet coils supplied from the line and its armature supplying a local circuit, and an adjustable resistance in the local circuit. (2) Consists in placing in the local circuit the operating magnet or magnets of an electro-magnetic brake acting, when energized, upon the wheels of the car. The power of this brake may be regulated by varying the strength of the field-magnet of the machine, or an adjustable resistance may be placed directly in the brake-circuit for this purpose, or both may be used.

340,698. Railway Signal; George F. Carlile, Cincinnati, O., assignor of one-half to George L. Thomas, same place. Consists of minor details in a system for signaling to the engineer.

(1) **340,707. Telephone Repeater**; (2) **340,708. Signaling Apparatus**; Thomas A. Edison, Menlo Park, N. J.; (3) **340,709. Telephone Circuit**; the above and Ezra T. Gilliland, Boston, Mass.

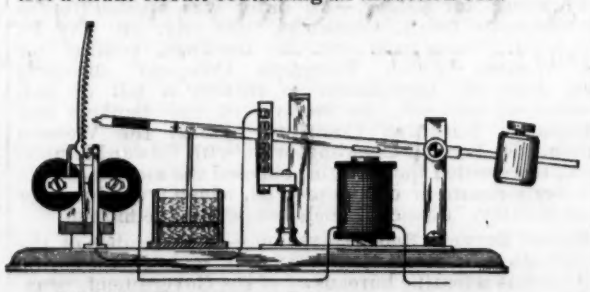


340,853. TELEPHONE TRANSMITTER.

(1) Consists of a receiving induction coil having two opposing primary circuits and a repeating induction-coil whose secondary circuit is connected with both the primary circuits of the receiving induction-coil.

(2) The way in which the instruments are operated is to close the line through the magnets, and as the arms move down operate the polarized relay, and so stop and lock them at the proper predetermined point to operate the signal, after which, the circuit being broken, the arms are brought back again above the series of contacts. The construction is shown in the cut.

(3) A loose ear-piece is provided and is adapted to control a shunt circuit containing an induction coil.



340,708. ELECTRICAL SIGNALING APPARATUS.

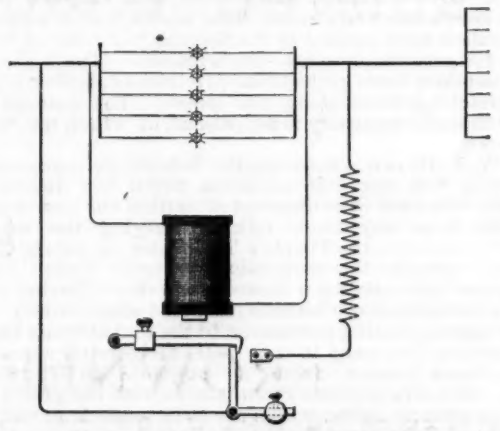
340,717. Multiple System; Arthur J. Holt, deceased, Grand Rapids, Mich., Frances J. Holt, administratrix. As shown in the cut, it consists of a group of electro-receptive devices in a multiple-series system and an automatic cut-out or shunt mechanism so constructed and arranged that upon the failure of any one or any predetermined number of the electro-receptive devices of the group, the cut-out or shunt will automatically throw in circuit, parallel with the remaining electro-receptive devices of the group, a shunt having a resistance less than the resistance of the electro-receptive devices (one or more) which have failed.

340,734. Insulator; Bert Seabold, Salt Lake City, Utah, Assignor of three-quarters to George and Samuel H. Goss, and Andrew L. Hosner, all of same place. The tie wire is surrounded by a plastic proof covering.

340,815. Electric Belt; Morgan Payne and Daniel Benton, Cardington, O. The cells are each of two plates, one of copper and one of zinc, cemented together at their edges by means of insulating material, the plates being so shaped as to leave a space for the exciting material.

340,853. Telephone; Emile Berliner, Washington, D. C. The construction is fully shown in the cut.

340,868. Cut-Out; John M. Fairchild, Portland, Oregon, Assignor to himself and James O'Conner, same place. Consists of contacts connected to the conducting-wires, a rotary adjustable switch-bar having its axis formed as a key-pin, a separable key for turning the switch-bar a yielding locking-bar for holding the switch-bar disconnected from its contact, a push-button for disengaging the locking-bar from the switch-bar, and a spring for retracting the switch-bar and closing the current through the cut-out and short-circuiting the line.



340,717. ELECTRICAL DISTRIBUTION.

340,890. Thermostat; Joseph H. Miller, Providence, R. I. It is arranged so that one circuit is normally open and another normally closed. Upon the temperature rising to a certain degree, the first closes and the second opens.

(1) **340,911. Signal Switch**; (2) **340,912. Circuit Breaker for Telephone Lines**; George H. Glass and Walter Clark, Raleigh, North Carolina. (1) Consists in an arrangement of main and local circuits and automatic switch device in connection therewith, whereby the head or receiving telephone of the attendant may be readily included in the main circuit to receive the vocal calls of the signaling subscriber, while the main or exchange signaling bell will be sounded in its local circuit by the said subscriber to insure response to the call should the head-telephone be unattended or removed, as at night. (2) By the construction the subscriber's circuit is only broken on one side of the armature.

340,931. Insulating Wires; David Brooks, Jr., Philadelphia, Pa., Assignor of one-half to Henry B. Tatham, same place. Braided tape containing wire to carry away induced currents is employed.